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Cost of Operation of a Central Heat, Light, and Power Plant

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THE COST OF OPERATION OF A CENTRAL HEAT, LIGHT, AND POWER PLANT

BY

CHARLES LEONARD SAMSON

AND

EDWIN GARDNER GREENMAN

THESIS FOR DEGREE OF BACHELOR OF SCIENCE
IN MECHANICAL ENGINEERING

COLLEGE OF ENGINEERING
UNIVERSITY OF ILLINOIS
PRESENTED JUNE 1902

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May 29, 1902 190

THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

Edwin Gardner Greenman and Charles Leonard Samson

ENTITLED The Cost of Operation of a Central Heat, Light and Power Plant

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE OF Bachelor of Science in Mechanical Engineering.

L. P. Breckenridge

HEAD OF DEPARTMENT OF Mechanical Engineering.

53830

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The object of this thesis is the determination of the cost of operating the heating, lighting, and power plant at the University of Illinois, Urbana Illinois so that the operating expenses could be compared with those of commercial plants.

The data used for arriving at results were taken at the plant during a period of three months beginning February 6, 1902, and consisted of such observations as are shown on the blanks here inserted. The observations were taken by intelligent engineers and firemen, being looked over and checked from time to time by the writers and are considered by them to be fairly free from error in that direction. The electrical instruments used were those in continual use by the plant. They were not tested or calibrated for this work but the electrical department, whose experimental laboratory adjoins the engine room, owns accurate or calibrated instruments which they continually used on the

plant in use and would have discovered such a fault in any boiler on the instruments on its switchboard.

In the boiler room a two inch Worthington hot water meter was used to measure the water pumped to the boilers. The water, which was taken from the return tank, connected to the heating system, averaged in temperature about 160° F except at times when the heat was shut off in most of the buildings and cold water was necessary. The water was pumped through a heater but not until it had gone through the meter and this variation in its temperature caused some leakage at the meter pistons. The meter was calibrated with cold water under no pressure and worked with hot water at boiler pressure. The error is considered small although it may have been of some magnitude. Had it been possible the calibration should have been made under working conditions, for the readings of the meter were the

primary data of the entire test because the evaporation of six pounds of water per pound of coal was made the basis for determining the coal consumption; and the boiler horse power was also calculated from these readings.

To check the meter a counter was placed on the pump and readings taken for a week or more; and assuming that the water cylinder was completely filled each stroke, the quantity of water pumped was compared with the meter readings. The comparison was unsatisfactory, however, probably because the water often became so hot that there was some possibility of steam in the water cylinders.

The assumption made for determining coal consumption was warranted by a large number of tests made at various times on the different boilers of the plant and with coal similar to that in use at the time of these determinations.

The power plant contains boilers of 1070 nominal horse power.

sisting of one Babcock and Wilcox 150 horse-power, water tube, high pressure hand fired boiler which is little used and which was originally installed for experimental work with high pressure steam; one 150 horse power Babcock and Wilcox water tube boiler equipped with chain grate which was run most of the time during the test. one 100 horse power horizontal tubular boiler equipped with Roughtonian stoker which is now connected directly to the heating mains at from five to ten pounds pressure; one 250 horse power water tube boiler equipped with Murphy furnace: and two 200 horse power Babcock and Wilcox water tube boilers set in one battery and equipped with Roney stokers. Like the blowers they are numbered from one to six in the order mentioned here. The inserted plan shows the arrangement of these boilers together with the details of the boiler and pumping plant

Water is supplied to the boilers by a Deane vertical packet plunger pressure pump which can be used as an alternative unit as it is a duplex pump, it is often run when the load is light. Adjoining the boiler room is the engine room which contains three steam pumps and a Snow eight by six by ten pressure pump; one Knowles underwriters fire pump, sixteen by nine by twelve of several hundred fifty gallons per minute capacity; and one Worthington eight by four and three quarter by twenty four inch deep well lifting pump. There is also here a Westinghouse air pump three and one half by three and one half by ten, used for maintaining the pressure on the top of the pressure tanks. The air pump is regulated automatically by the water pressure

The engine room, which by the general plan of the buildings and grounds is shown to be in a

Building adjoining the Lumber Room, Londesborough the engineer is now supplying light and power for use on the campus. Aside from the 10 horse power Robinson engine which is used solely for running the coal conveying machinery in the boiler house, there are three other engines and of which is generally lying idle. The Westinghouse 50 horse power engine is belted through the jack shaft to a twenty light wood arc machine. This machine is run during the night at present but in the future to full capacity. Lamp hangs are provided on the jack shaft so that the machines and engines can be run in almost any combination but that one unit of the plant is generally disconnected and the Westinghouse engine and the arc machine run together. The engine which is used most is the 100 horse power Ideal Compound which is running all the time that there is a heavy load on the plant. It is

generally a little from 9 P.M. when the library closes until noon of the next day are started almost every night in the morning. The I.H.P. simplex 30 horse power engine is generally run in connection with the air compressor during the day.

The voltage on the plant current is four hundred forty and the three wire system of distribution is used. In all the buildings except the new gymnasium and in one shop it is taken through transformers for sixteen candle power lamps and the watt hour meters. There two new buildings, the new dormitory and power house will be wired for two thousand twenty watt lamps.

The heating system includes all the buildings shown on the plan of the campus and the amount of radiation is given on the table, page 11 the boiler horse power required can be determined effectively by deducting the 2 per cent for of the radiating surface for piping.

It was originally intended to take readings every two hours throughout the day and night, but the fact that the load was so variable made this practically impossible, for readings of the electrical instruments could not well be taken oftener than twice a day.

Table I, pages 20, 21, and 22 gives the total and itemized cost of operation per day of twenty four hours. The total cost as shown by meter from 50 to 100 H.P. of variable power was found to be 8 cents per hour. Table II pages 23, 24, and 25 gives the total and itemized cost of operation per horse power hour. The cost varied from 0.118 to 0.178

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WEEKLY ENGINE ROOM RECORD

YEAR..... MONTH.....	SUNDAY		MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY		SATURDAY	
Westinghouse														
Ideal Compound														
Ideal Simple														
Coal Engine														
Arc Machine D. C.														
500 Volt D. C.														
75 K W A. C.														
45 K W A. C.														
20 Amp Exciter														
15 Amp Exciter														
Air Compressor														
	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.
D. C. Voltmeter														
A. C. Voltmeter														
A. C. Voltmeter														
D. C. Ammeter														
A. C. Ammeter														
No. Arc Lights														
Arc Machine Amperes														
Cylinder Oil														
Crank Case Oil														
Engine Oil														
Kerosine														
Gasoline														
Waste														
	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT

300-2-02-0

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WEEKLY BOILER ROOM RECORD

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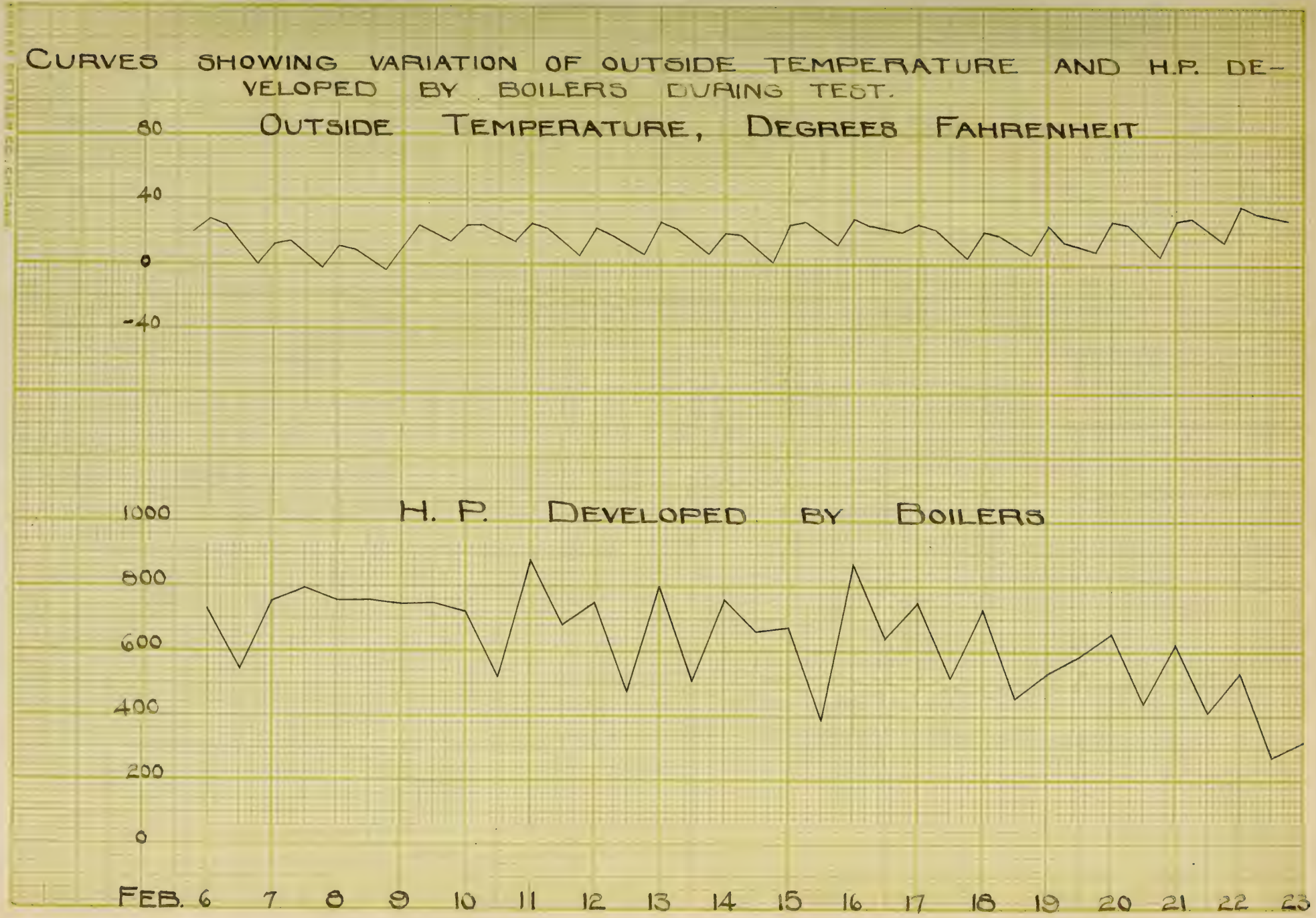
WEEKLY BOILER ROOM RECORD

Year ... Month ...	Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday	
	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP	START	STOP
Boiler No. 1														
Boiler No. 2														
Boiler No. 3														
Boiler No. 4														
Boiler No. 5														
Boiler No. 6														
Feed Pump														
Fire Pump														
Pressure Pump														
	DIR.	AMT.	DIR.	AMT.	DIR.	AMT.	DIR.	AMT.	DIR.	AMT.	DIR.	AMT.	DIR.	AMT.
Wind 6 A. M.														
Wind 6 P. M.														
Temperature	6 A. M.	6 P. M.	6 A. M.	6 P. M.	6 A. M.	6 P. M.	6 A. M.	6 P. M.	6 A. M.	6 P. M.	6 A. M.	6 P. M.	6 A. M.	6 P. M.
Feed Water														
	6 A.M.	12 M.	6 P.M.	6 A.M.	12 M.	6 P.M.	6 A.M.	12 M.	6 P.M.	6 A.M.	12 M.	6 P.M.	6 A.M.	12 M.	6 P.M.	6 A.M.	12 M.	6 P.M.	6 A.M.	12 M.	6 P.M.	6 A.M.	12 M.	6 P.M.	6 A.M.	12 M.	6 P.M.
Outside Temperature																										
Inside Temperature																										
Weather 6 A. M.																										
Weather 6 P. M.																										
Draft at 12 M.																										
Water Meter 6 A. M.																										
Water Meter 6 P. M.																										
Pounds Water Night																										
Pounds Water Day																										
H. P. Night																										
H. P. Day																										
Tons Coal																										
Lbs. Ashes																										
Cylinder Oil																										
Lard Oil																										
Machine Oil																										
Waste																										
	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT

Table Showing Square Feet of Radiation Supplied by Central Heating Plant

Location	Square Feet of Radiation
Agricultural Building	16000
*Library	2901
Gymnasium	6000
Wood Shop	2100
Laboratory of Applied Mechanics	1800
Engineering Hall	10700
President's House	1385
Armory	2880
Machine Shop	2900
Natural History Building	8954
Main Building	12000
Engineering Laboratory	2730
Chemical Laboratory	3610
Greenhouse	1030
Total	74990

*Note: Fan system is installed in Library and one ~~square~~ foot of radiation in front of a fan will condense about four times as much steam as one square foot of ordinary radiation.


CURVES SHOWING VARIATION OF OUTSIDE TEMPERATURE AND H.P. DEVELOPED BY BOILERS DURING TEST.
OUTSIDE TEMPERATURE, DEGREES FAHRENHEIT
80
40
0
-40
H. P. DEVELOPED BY BOILERS
1000
800
600
400
200
0
FEB. 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

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OUTSIDE TEMPERATURE, DEGREES FAHRENHEIT
80
40
0
-40
H. P. DEVELOPED BY BOILERS
1000
800
600
400
200
0
FEB. 23 24 25 26 27 28 MAR 2 3 4 5 6 7 8 9 10 11 12 13

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80
OUTSIDE TEMPERATURE, DEGREES FAHRENHEIT
40
0
-40
1000
H.P. DEVELOPED BY BOILERS
800
600
400
200
0
MAR. 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

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OUTSIDE TEMPEPATURE, DEGREES FAHRENHEIT
80°
40°
0°
H.P. DEVELOPED BY BOILERS
1000
800
600
400
200
0
APRIL 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

LIBRARY
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OUTSIDE TEMPERATURE, DEGREES FAHRENHEIT
80°
40°
0°
H.P. DEVELOPED BY BOILERS
1000
800
600
400
200
0
APRIL
17 18 19 20 21 22 23 24 25 26 27 28 29 30

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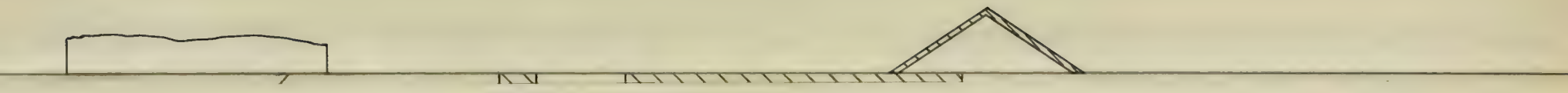
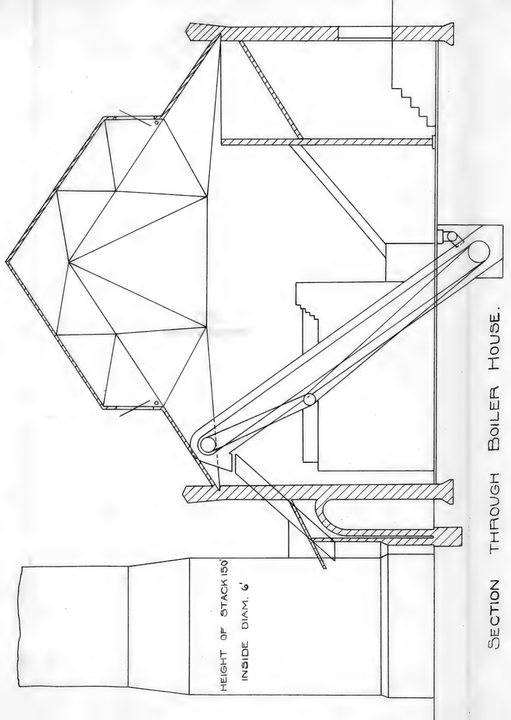
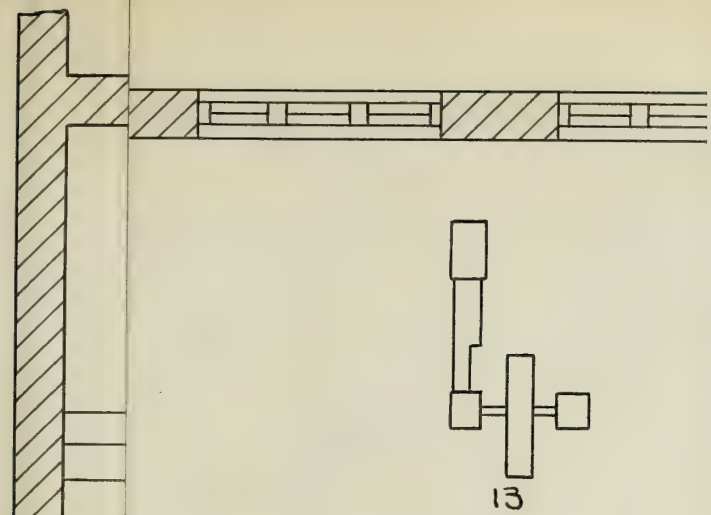




SECTION THROUGH BOILER HOUSE.

PLAN OF CENTRAL BOILER AND PUMPING STATION
UNIVERSITY OF ILLINOIS
SCALE 1" = 8'

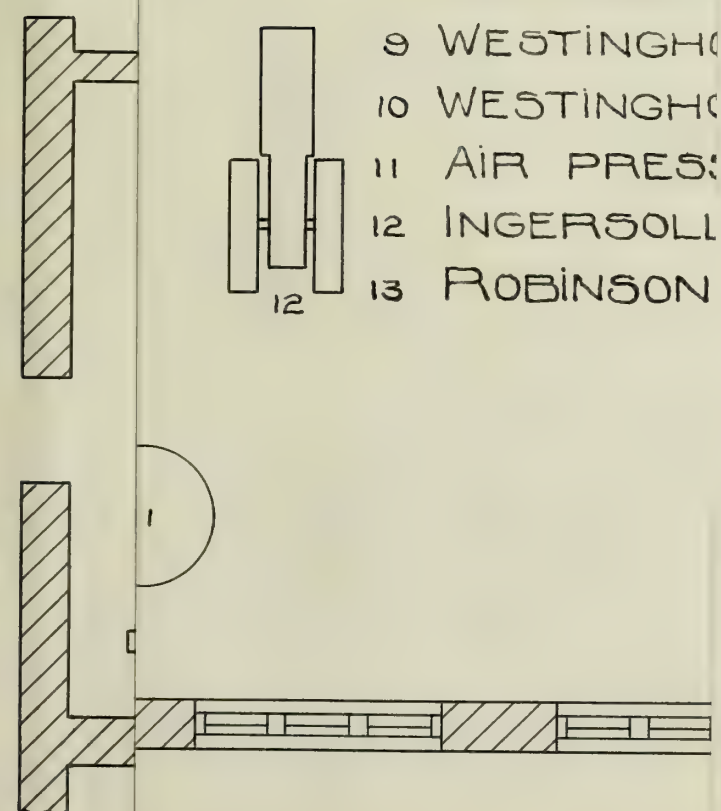
STACK
SMOKE FLUE
150 H.P. HIGH PRESS URE B.+W. BOILER, HAND-FIRED.
150 H.P. B.+W. BOILER, CHAIN GRATE.
100 H.P. HORIZON-TAL TUB-ULAR BOILER.
250 H.P. NATIONAL WATER-TUBE BOILER.
TWO 220 H.P. B. AND W. BOILERS
METROPOLITAN PURIFIER
BERRYMAN HEATER
FEED PUMP, DEAN
BRIGHT-MAN STOKER
MURPHY FURNACE
RONEY STOKER
ASH CONVEYOR
UP
COAL CHUTE
CHUTE
CHUTE
CHUTE
CHUTE
CHUTE
HOPPER
COAL BINS
UP
TUNNEL
COAL CONVEYOR
COAL BINS
COAL BIN
WORTHINGTON PUMP
RETURN TANK
AIR LIFT 160' WELL
STORAGE TANK
PRESSURE TANK
TUNNEL
UP
AIR PUMP
PRESSURE PUMP
FIRE PUMP
LIFTING PUMP
STORAGE TANK
PRESSURE TANK
N
E
S
W



13

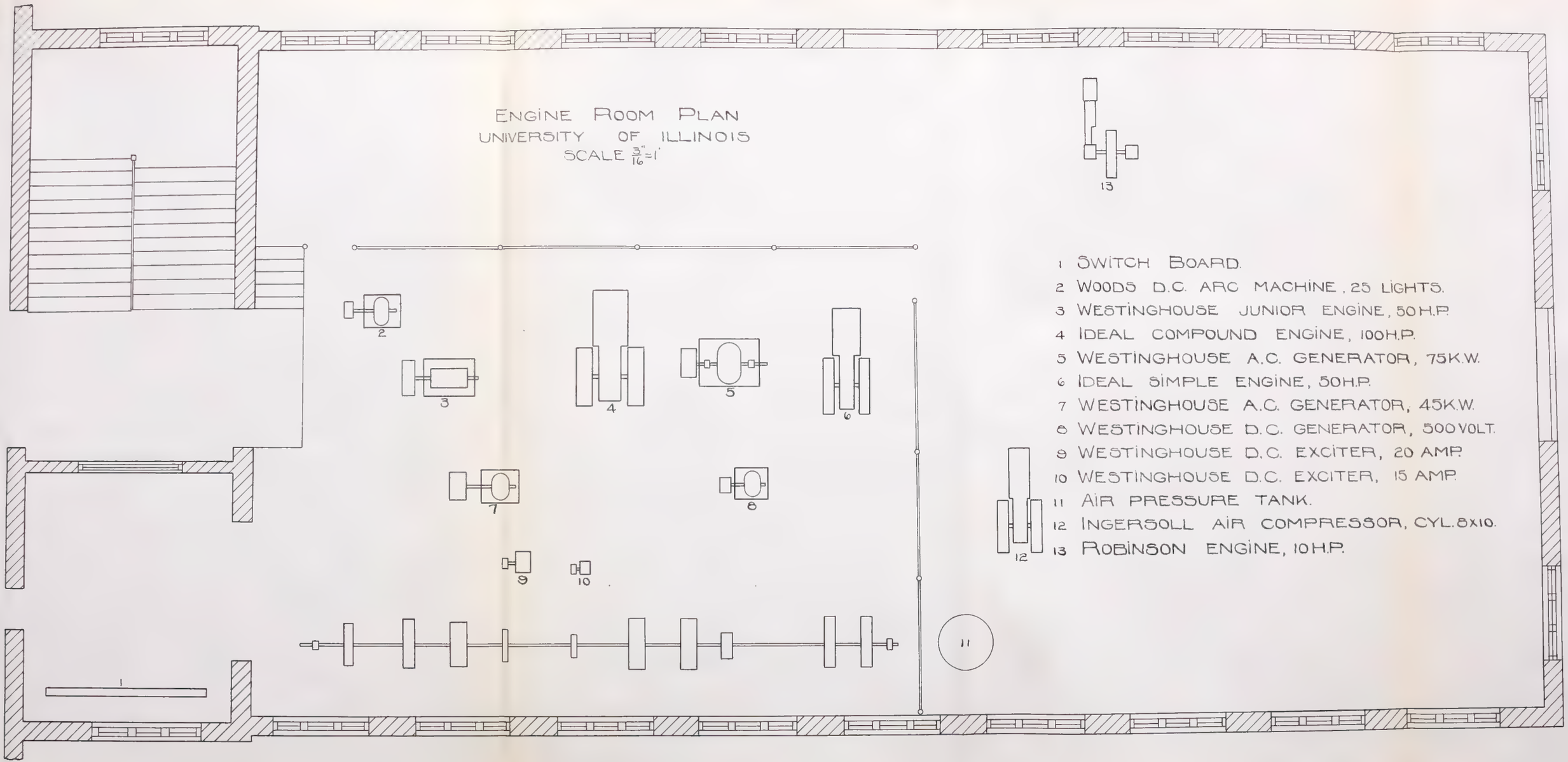
1 SWITCH B
2 WOODS D.C
3 WESTINGHO
4 IDEAL COM
5 WESTINGH
6 IDEAL SIM
7 WESTINGH
8 WESTINGH
9 WESTINGH
10 WESTINGH
11 AIR PRES
12 INGERSOLL
13 ROBINSON

12

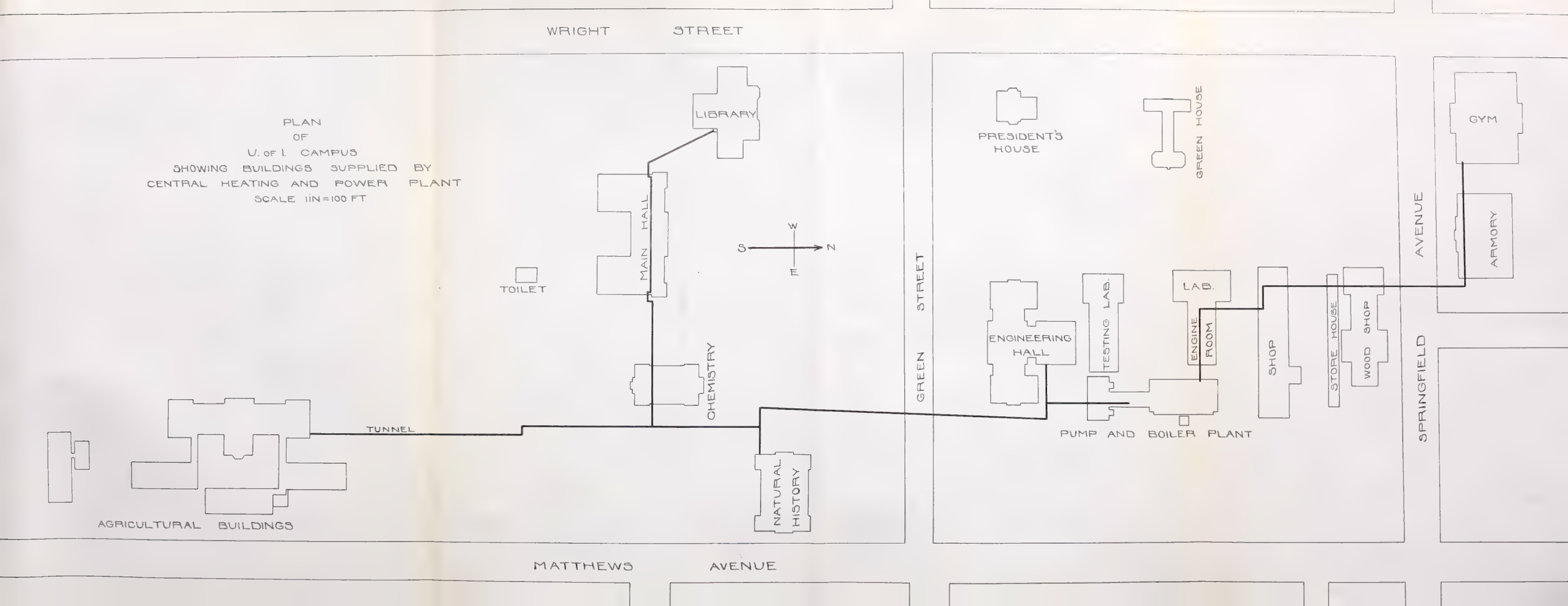


1

ENGINE ROOM PLAN
UNIVERSITY OF ILLINOIS
SCALE $\frac{3}{16}$"=1'



1 SWITCH BOARD.
2 WOODS D.C. ARC MACHINE, 25 LIGHTS.
3 WESTINGHOUSE JUNIOR ENGINE, 50 H.P.
4 IDEAL COMPOUND ENGINE, 100 H.P.
5 WESTINGHOUSE A.C. GENERATOR, 75 K.W.
6 IDEAL SIMPLE ENGINE, 50 H.P.
7 WESTINGHOUSE A.C. GENERATOR, 45 K.W.
8 WESTINGHOUSE D.C. GENERATOR, 500 VOLT.
9 WESTINGHOUSE D.C. EXCITER, 20 AMP.
10 WESTINGHOUSE D.C. EXCITER, 15 AMP.
11 AIR PRESSURE TANK.
12 INGERSOLL AIR COMPRESSOR, CYL. 8x10.
13 ROBINSON ENGINE, 10 H.P.


WRIGHT STREET
PLAN
OF
U. OF I. CAMPUS
SHOWING BUILDINGS SUPPLIED BY
CENTRAL HEATING AND POWER PLANT
SCALE 1IN=100 FT
LIBRARY
MAIN HALL
TOILET
CHEMISTRY
NATURAL HISTORY
TUNNEL
AGRICULTURAL BUILDINGS
W
S
N
E
GREEN STREET
PRESIDENT'S HOUSE
GREEN HOUSE
GYM
ARMORY
SPRINGFIELD AVENUE
ENGINEERING HALL
TESTING LAB.
LAB.
ENGINE ROOM
SHOP
STORE HOUSE
WOOD SHOP
PUMP AND BOILER PLANT
MATTHEWS AVENUE

Date	H. P. Developed	Coal
6	637	55.
7	775	66.
8	757	66.
9	746	65.
10	662	54.
11	780	68.
12	612	51.
13	654	56.
14	710	62.
15	530	50.
16	751	65.
17	635	55.
18	594	51.
19	567	49.
20	549	46.
21	519	45.
22	404	33.
23	364	31.
24	518	42
25	429	38.
26	659	58.
27	404	33.
28	422	36.
Total	13678	1174.
Average	594	51.

TABLE I. MONTH OF FEBRUARY COST PER DAY OF 24 HOURS

Date	H. P. Developed	EXPENSE OF OPERATION					FIXED CHARGES				Total cost $
		Coal $	Labor $	Oil, waste $	Repairs $	Total $	Inspection $	Interest $	Depreciation $	Total	
6	637	33.78	18.	.195	Bills left	74.16	2.19	8.1	5.55	15.92	90.08
7	775	66.62	18.09	..	running	84.89	..	..	..	..	100.81
8	757	66.15	18.09	..		84.44	..	..	..	..	100.36
9	746	65.15	11.96	..		77.29	..	..	..	..	93.21
10	662	54.42	16.81	..		71.43	..	..	..	..	87.35
11	780	68.12	16.95	..		85.25	..	..	..	..	101.17
12	612	51.25	16.93	..		68.42	..	..	..	..	84.34
13	654	56.74	16.81	..		73.73	..	..	..	..	89.65
14	710	62.10	17.18	..		79.47	..	..	..	..	95.40
15	530	50.14	16.81	..		67.13	..	..	..	..	83.05
16	751	65.63	12.	..		77.95	..	..	..	..	93.87
17	635	55.49	14.51	..		70.24	..	..	..	..	86.16
18	594	51.90	14.40	..		66.50	..	..	..	..	82.42
19	567	49.04	14.47	..		63.69	..	..	..	..	79.61
20	549	46.13	14.47	..		60.80	—	..	..	..	76.62
21	519	45.95	15.25	..		61.38	..	..	..	..	77.30
22	404	33.34	13.50	..		47.44	..	..	..	..	63.36
23	364	31.78	10.85	..		42.81	..	..	..	..	58.73
24	518	42.15	16.42	..		58.77	..	..	..	..	74.69
25	429	38.16	16.54	..		54.88	..	..	..	..	70.80
26	659	58.22	16.54	..		74.96	..	..	..	..	90.88
27	404	33.26	16.61	..		49.95	..	..	..	..	65.81
28	422	36.80	16.54	..		53.54	..	..	..	..	69.46
Total	13678	1174.32	360.19	44.85		1538.99	50.37	188.14	127.65	366.16	1905.51
Average	594	51.06	15.69	.195		66.95	2.19	8.18	5.55	15.92	82.87

Date	H.P. Developed	Coc
1	437	38.
2	435	35.
3	449	40.
4	504	44.
5	558	39.
6	387	33.
7	553	48.
8	437	35.
9	305	26.
10	493	43.
11	337	29.
12	517	46.
13	600	52.
14	525	47.
15	489	41.
16	609	53.
17	474	41.
18	658	55.
19	542	48.
20	517	45
21	445	38.
22	391	34
23	363	31.
24	310	27.
25	412	35.
26	401	33.
27	367	32.
28	363	31.
29	342	31.
30	299	36.
31	538	47.
Total	14057	123
Average	453	37.

TABLE I MONTH OF MARCH COST PER DAY OF 24 HOURS

Date	H.P. Developed	EXPENSE OF OPERATION					FIXED CHARGES				Total Cost
		Coal	Labor	Oil, Waste	Repairs	Total	Inspection	Interest	Depreciation	Total	
1	437	38.10	16.36	.135		54.59	2.19	8.18	5.55	15.92	
2	435	35.74	13.14	"		49.01	"	"	"	"	70.57
3	449	40.27	16.63	"	1.20	58.13	"	"	"	"	64.94
4	504	44.12	16.63	"	1.30	62.06	"	"	"	"	74.05
5	558	39.78	16.63	"		56.55	"	"	"	"	77.98
6	387	33.81	16.63	"		50.57	"	"	"	"	72.37
7	553	48.48	16.63	"		65.25	"	"	"	"	66.49
8	437	35.08	17.14	"	9.60	61.95	"	"	"	"	81.17
9	305	26.76	11.24	"		38.14	"	"	"	"	77.87
10	493	43.39	17.33	"		60.78	"	"	"	"	54.06
11	337	29.44	19.25	"	.50	49.33	"	"	"	"	76.70
12	517	46.20	18.95	"		65.28	"	"	"	"	65.25
13	600	52.44	19.40	"		71.98	"	"	"	"	81.20
14	525	47.27	20.04	"		67.45	"	"	"	"	77.80
15	489	41.95	19.52	"		61.48	"	"	"	"	83.31
16	609	53.70	12.14	"		65.97	"	"	"	"	77.40
17	474	41.42	19.90	"		61.46	"	"	"	"	81.89
18	658	55.75	16.90	"		72.65	"	"	"	"	77.37
19	542	48.65	22.44	"	.96	82.19	"	"	"	"	88.57
20	517	45.45	22.32	"		67.90	"	"	"	"	98.10
21	445	38.95	22.44	"		61.53	"	"	"	"	83.82
22	391	34.40	22.32	"		56.85	"	"	"	"	11.44
23	363	31.75	11.16	"		43.04	"	"	"	"	72.78
24	310	27.42	17.58	"		45.14	"	"	"	"	59.96
25	412	35.99	14.93	"	2.40	53.45	"	"	"	"	61.06
26	401	33.09	15.05	"	8.15	56.43	"	"	"	"	72.35
27	367	32.14	16.77	"		49.03	"	"	"	"	64.95
28	363	31.69	16.30	"		48.13	"	"	"	"	64.05
29	342	31.05	16.30	"		47.47	"	"	"	"	63.39
30	299	36.15	10.94	"		41.23	"	"	"	"	57.15
31	538	47.	14.83	"	4.24	62.19	"	"	"	"	78.11
Total	14057	1231.36	527.84	4.13	28.33	1791.66	61.89	253.58	171.05	492.52	2284.18
Average	453	39.72	17.02	.135	.91	57.80	2.19	8.18	5.55	15.92	73.68

Date	H.P. Developed	Coa
1	503	43
2	393	34
3	374	33
4	465	40
5	328	33
6	297	26
7	590	49
8	479	42
9	391	34
10	391	34
11	405	36
12	399	33
13	332	29
14	433	33
15	421	37
16	398	34
17	418	36
18	391	34
19	416	36
20	315	27
21	348	30
22	382	33
23	317	27
24	361	32
25	379	33
26	365	31
27	253	22
28	306	26
29	305	26
30	309	27
Total	11531	101
Average	384	32

* Old bill from Feb

TABLE I MONTH OF APRIL COST PER DAY OF 24 HOURS

Date	H.P. Developed	EXPENSE OF OPERATION					FIXED CHARGES				Total Cost
		Coal	Labar	Oil Waste	Repairs	Total	Inspection	Interest	Depreciation	total	
1	503	43.69	15.57	.175	1.	60.45	2.19	8.18	5.55	15.92	76.37
2	393	34.94	15.44	..	.85	50.61	..	..	..	..	66.53
3	374	33.55	16.07	..		49.79	..	..	..	..	65.71
4	465	40.35	16.64	..	4.75	61.72	..	..	..	..	77.64
5	328	33.91	15.58	..	1.60	51.46	..	..	..	..	67.38
6	297	26.12	12.07	..	*40.80	79.11	..	..	..	..	85.09
7	590	49.90	16.18	..	1.60	67.85	..	..	..	..	83.77
8	479	42.13	15.14	..		57.45	..	..	..	..	73.37
9	391	34.33	15.72	..		50.20	..	..	..	..	66.12
10	391	34.77	14.11	..		49.06	..	..	..	..	64.98
11	405	36.10	14.35	..		51.65	..	..	..	..	67.57
12	399	35.03	9.79	..		45.00	..	..	..	..	60.92
13	332	29.07	15.23	..		44.49	..	..	..	..	60.41
14	433	35.65	14.85	..	.40	50.90	..	..	..	..	66.82
15	421	37.35	14.35	..		52.37	..	..	..	..	68.29
16	378	34.90	14.85	..		49.93	..	..	..	..	65.85
17	418	36.09	16.10	..	1.80	54.16	..	..	..	..	70.08
18	391	34.33	17.35	..		51.85	..	..	..	..	67.77
19	416	36.48	17.87	..		54.52	..	..	..	..	70.44
20	315	27.61	10.48	..		38.25	..	..	..	..	70.17
21	348	30.39	16.63	..		49.19	..	..	..	..	65.11
22	382	33.50	17.60	..		51.38	..	..	..	..	67.54
23	317	27.62	14.58	..		42.37	..	..	..	..	59.29
24	361	32.49	16.08	..		48.75	..	..	..	..	64.67
25	379	33.23	15.83	..		49.23	..	..	..	..	65.15
26	365	31.23	16.08	..	.20	57.70	..	..	..	..	73.62
27	253	22.14	11.87	..		34.19	..	..	..	..	50.11
28	306	26.82	14.61	..		41,61	..	..	..	..	57.53
29	305	26.62	14.61	..		41.40	..	..	..	..	57.32
30	309	27.06	13.91	..	.75	41.90	..	..	..	..	57.75
Total	11531	1013.62	450	5.42	5.375	1522.17	67.89	245.58	172.05	493.52	2015.69
Average	384	32.69	14.84	.175	1.73	52.91	2.19	8.18	5.55	15.92	68.83

* Old bill from Feb for castings

MON

Date	Total HP	Coc
6	637	.08
7	775	.08
8	757	.08
9	746	.08
10	662	.086
11	780	.087
12	612	.083
13	654	.08
14	710	.08
15	530	.08
16	751	.08
17	635	.08
18	594	.08
19	567	.08
20	549	.08
21	519	.08
22	404	.08
23	364	.089
24	518	.086
25	429	.088
26	659	.086
27	404	.08
28	422	.08
Totals	13678	1.99
Averages	594	.08

MONTH OF FEBRUARY TABLE II COST PER H.P. PER HOUR, PER DAY OF 24 HOURS

Date	Total H.P.	EXPENSE OF OPERATION					FIXED CHARGES				Total Cost
		Coal	Labor	Oil Waste	Repairs	Total	Inspection	Interest	Depreciation	Total	
6	637	.0875	.0282	.0005	Feb bills	.1160	.0034	.0128	0087	.0249	.1409
7	775	.0859	.0232	.0002	left running	.1093	.0028	.0105	.0071	.0194	.1187
8	757	.0873	.0239	.0002		.1114	.0029	.0108	.0073	.0210	.1324
9	746	.0873	.0160	.0002		.1095	.0029	.0107	.0073	0211	.1186
10	662	.0869	.0254	.0003		.1079	.0033	.0122	.0082	.0237	.1316
11	780	.0873	.0217	.0002		.1092	.0027	.0105	.0071	.0203	.1296
12	612	.0833	.0276	.0003		.1106	0034	.0133	.0093	.0260	.1366
13	654	.0867	.0257	.0002		.1126	.0033	.0123	.0084	.0242	.1368
14	710	.0874	.0258	.0002		.1134	0030	.0115	.0078	.0213	.1347
15	530	.0872	.0242	.0002		.1116	0034	.0118	.0080	0232	.1348
16	751	.0873	.0159	.0002		.1134	0029	.0109	.0073	0211	.1345
17	635	.0873	.0229	.0003		.1105	0036	.0128	.0097	0281	.1386
18	594	.0873	.0242	.0003		.1118	.0037	.0138	.0093	.0268	.1374
19	567	.0865	.0239	.0003		.1106	.0037	.0144	.0097	.0278	.1383
20	549	.0840	.0263	.0003		.1106	0038	.0147	.0102	.0197	.1389
21	519	.0885	.0293	.0003		.1181	.0042	.0159	.0107	.0308	.1489
22	404	.0825	.0267	.0004		.1086	.0054	.0202	.0137	.0393	.1479
23	364	.0890	.0298	.0005		.1193	.0060	.0221	.0151	.0413	.1606
24	518	.0869	.0317	.0003		.1134	.0042	.0158	.0107	.0307	.1441
25	429	.0889	.0385	.0003		.1277	.0051	.0190	0129	.0370	.1647
26	659	.0867	.0251	.0002		.1120	.0033	.0125	.0084	.0242	.1362
27	404	.0870	.0411	.0004		.1240	.0054	.0202	.0137	.0393	1633
28	422	.0874	.0409	.0004		.1287	.0052	.0193	.0131	.0376	.1663
Totals	13678	1.9981	.6180	.0065		2.8026	.0857	.3386	.2237	.6180	3.4206
Averages	594	.0869	.0268	.00028		.1165	.0037	.0147	.0097	.0241	.1406

MONTH OF MARCH

Date	Total H. P	EXPENSE OF Coal	Labo	Total cost
1	437	.0871	.0361	.1548
2	435	.0869	.0301	.1535
3	449	.0887	.0371	.1642
4	504	.0875	.0331	.1549
5	558	.0869	.0361	.1581
6	387	.0873	.0421	.1715
7	553	.0876	.0301	.1465
8	437	.0803	.0392	.1779
9	305	.0877	.0368	.1770
10	493	.0878	.0351	.1559
11	337	.0873	.0588	.1967
12	517	.0893	.0362	.1564
13	600	.0874	.0323	.1454
14	525	.0876	.0381	.1527
15	489	.0856	.0400	.1320
16	609	.0881	.0199	.1559
17	474	.0874	.0420	.1494
18	658	.0869	.0256	.1549
19	442	.0887	.0414	.1621
20	517	.0879	.0431	.1688
21	445	.0874	.0504	.1800
22	391	.0876	.0570	.1862
23	363	.0873	.0308	.1703
24	310	.0880	.0567	.1963
25	412	.0873	.0362	.1682
26	401	.0875	.0375	.1840
27	367	.0876	.0457	.1756
28	363	.0875	.0449	.1732
29	342	.0880	.0476	.1823
30	299	.0878	.0364	.1785
31	538	.0875	.0275	.1556
Totals	14057	2.7087	1.2053	5.0331
Average	453	.0872	.0385	.1623

MONTH OF MARCH TABLE II COST PER HP PER HOUR PER DAY OF 24 HOURS

Date	Total H. P	EXPENSE OF OPERATION.					FIXED CHARGES				Total cost
		Coal	Labor	Oil waste	Repairs	Total	Inspection	Interest	Depreciation	Total	
1	437	.0871	.0367	.0003		.1241	.0051	.0187	.0127	.0307	.1548
2	435	.0869	.0302	.0003		.1174	.0050	.0185	.0126	.0361	.1535
3	449	.0887	.0370	.0003	.0028	.1288	.0049	.0182	.0123	.0354	.1642
4	604	.0875	.0330	.0003	.0026	.1234	.0043	.0162	.0110	.0315	.1549
5	558	.0869	.0363	.0003		.1233	.0047	.0174	.0121	.0346	.1581
6	387	.0873	.0429	.0003		.1305	.0056	.0211	.0143	.0410	.1715
7	553	.0876	.0300	.0003		.1179	.0039	.0147	.0100	.0286	.1465
8	437	.0803	.0392	.0003	.0220	.1418	.0048	.0187	.0126	.0361	.1779
9	305	.0877	.0368	.0005		.1250	.0071	.0268	.0181	.0520	.1770
10	493	.0878	.0351	.0004		.1233	.0044	.0168	.0112	.0324	.1559
11	337	.0873	.0588	.0005	.0055	.1481	.0067	.0250	.0169	.0486	.1967
12	517	.0893	.0362	.0003		.1258	.0042	.0158	.0108	.0306	.1564
13	600	.0874	.0323	.0003		.1190	.0036	.0136	.0098	.0264	.1454
14	525	.0876	.0381	.0003		.1260	.0047	.0155	.0105	.0267	.1527
15	489	.0856	.0400	.0004		.1083	.0045	.0178	.0114	.0237	.1320
16	609	.0881	.0199	.0003		.1298	.0036	.0134	.0091	.0261	.1559
17	474	.0874	.0420	.0004		.1128	.0046	.0182	.0138	.0366	.1494
18	658	.0869	.0256	.0003		.1304	.0033	.0128	.0084	.0245	.1549
19	442	.0887	.0414	.0003	.0017	.1330	.0040	.0149	.0102	.0291	.1621
20	517	.0879	.0431	.0003		.1381	.0042	.0158	.0107	.0307	.1688
21	445	.0874	.0504	.0003		.1441	.0049	.0184	.0126	.0359	.1800
22	391	.0876	.0570	.0004		.1455	.0056	.0202	.0142	.0407	.1862
23	363	.0873	.0308	.0004		.1285	.0060	.0225	.0153	.0418	.1703
24	310	.0880	.0567	.0004		.1455	.0070	.0263	.0179	.0512	.1963
25	412	.0873	.0362	.0004	.0058	.1297	.0053	.0198	.0134	.0385	.1682
26	401	.0875	.0375	.0003	.0204	.1447	.0054	.0202	.0137	.0393	.1840
27	367	.0876	.0457	.0003		.1336	.0059	.0222	.0139	.0420	.1756
28	363	.0875	.0449	.0003		.1327	.0060	.0225	.0140	.0425	.1752
29	342	.0880	.0476	.0003		.1359	.0063	.0239	.0162	.0464	.1823
30	299	.0878	.0364	.0003		.1255	.0073	.0272	.0185	.0530	.1785
31	538	.0875	.0275	.0004	.0080	.1234	.0039	.0152	.0131	.0322	.1556
Totals	14057	2.7087	1.2053	.0105	.0648	3.9881	.1559	.3882	.4009	1.0450	5.0331
Average	453	.0872	.0385	.00034	.0021	.1291	.0053	.0190	.0129	.0337	.1623

MONTH C

Date	Total HP	Coa
1	503	.08
2	393	.08
3	374	.08
4	465	.08
5	378	.08
6	297	.08
7	590	.08
8	497	.08
9	391	.08
10	391	.08
11	405	.08
12	399	.08
13	332	.08
14	433	.08
15	421	.08
16	398	.08
17	418	.08
18	391	.08
19	416	.08
20	315	.08
21	348	.08
22	382	.08
23	317	.08
24	361	.08
25	379	.08
26	365	.10
27	253	.09
28	306	.08
29	305	.08
30	309	.08
Total	11331	2.61
Average	384	.0

MONTH OF APRIL TABLE II COST PER HP PER HOUR PER DAY OF 24 HOURS

Date	Total HP	EXPENSE OF OPERATION					FIXED CHARGES				Total cost
		Coal	Labor	Oil Waste	Repairs	Total	Inspection	Interest	Depreciation	Total	
1	503	.0872	.0309	.0003	.0020	.1205	.0040	.0162	.0102	.0304	.1509
2	393	.0875	.0393	.0004	.0021	.1293	.0056	.0209	.0152	.0415	.1708
3	374	.0873	.0429	.0004		.1306	.0058	.0218	.0137	.0413	.1719
4	465	.0874	.0371	.0003	.0102	.1250	.0047	.0175	.0119	.0341	.1591
5	378	.0872	.0420	.0004	.0035	.1331	.0056	.0216	.0146	.0418	.1749
6	297	.0876	.0407	.0005	.1542	.2830	.0074	.0276	.0187	.0537	.3367
7	590	.0874	.0294	.0003	.0043	.1214	.0037	.0138	.0094	.0269	.1483
8	497	.0876	.0316	.0003		.1195	.0045	.0171	.0111	.0227	.1423
9	391	.0872	.0402	.0004		.1278	.0056	.0209	.0152	.0415	.1693
10	391	.0874	.0366	.0004		.1238	.0056	.0209	.0152	.0415	.1653
11	405	.0877	.0355	.0004		.1232	.0054	.0232	.0137	.0393	.1625
12	399	.0860	.0245	.0004		.1109	.0054	.0233	.0138	.0396	.1305
13	332	.0876	.0449	.0005		.1330	.0066	.0246	.0167	.0479	.1809
14	433	.0860	.0342	.0004	.0009	.1210	.0050	.0188	.0138	.0376	.1586
15	421	.0864	.0353	.0004		.1241	.0052	.0194	.0131	.0377	.1618
16	398	.0869	.0373	.0004		.1246	.0054	.0233	.0138	.0396	.1642
17	418	.0863	.0384	.0004	.0042	.1293	.0052	.0195	.0132	.0379	.1676
18	391	.0872	.0443	.0004		.1319	.0056	.0209	.0152	.0415	.1734
19	416	.0874	.0432	.0004		.1310	.0052	.0196	.0133	.0381	.1691
20	315	.0871	.0332	.0005		.1208	.0069	.0259	.0175	.0503	.1711
21	348	.0870	.0477	.0005		.1352	.0063	.0235	.0159	.0457	.1746
22	382	.0877	.0460	.0004		.1341	.0056	.0216	.0146	.0418	.1759
23	317	.0871	.0360	.0005		.1236	.0071	.0256	.0175	.0504	.1740
24	361	.0880	.0445	.0004		.1329	.0060	.0226	.0153	.0439	.1768
25	379	.0878	.0418	.0004		.1300	.0056	.0216	.0146	.0418	.1718
26	365	.1022	.0440	.0004	.0005	.1481	.0060	.0224	.0152	.0436	.1917
27	253	.0910	.0469	.0006		.1365	.0086	.0223	.0217	.0526	.1891
28	306	.0875	.0477	.0005		.1358	.0071	.0261	.0171	.0403	.1761
29	305	.0876	.0477	.0005		.1359	.0071	.0261	.0170	.0402	.1761
30	309	.0875	.0450	.0005	.0023	.1423	.0071	.0260	.0169	.0440	.1863
Total	11331	2.6130	1.1880	.0120	.1799	3.9920	.1740	.6630	.4620	1.3990	5.3910
Average	384	.0871	.0396	.0004	.0040	.1310	.0058	.0221	.0154	.0433	.1743

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ENGINE ROOM RECORD.

Feb. 1902	6		7		8		9		10		11		12		13		14		15		16		17		18		19	
	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop
Westinghouse													PM 2:	AM 6:	PM 5	AM 6:40	PM 5	AM 6:40	PM 8:	AM 6:50					PM 5:40	AM 6:10	PM 5:25	AM 6:30
Ideal Comp.	AM 6:20								A.M. 6:40	AM 7:	AM 6:46	PM 6:20	AM 6:55	PM 10:	AM 6:30	PM 10:	AM 6:30	PM 10:	AM 6:40	P.M. 10:			AM 6:	PM 9:15	A.M. 6:10	P.M. 9:15	A.M. 6:30	P.M. 9:20
Ideal Simp.	AM 6:	PM 10	A.M. 6:	P.M 10:	A.M. 6	P.M 10:	AM 9:	P.M. 10:	AM 4:	P.M. 10:	A.M. 1:	P.M. 7:	AM 12:30	PM 7:	AM 7:	PM 7:	AM 6:50	PM 7:	AM 4:	PM 7:			A.M. 7:20	P.M. 6:20	A.M. 7:20	P.M. 6:30	A.M. 7:	P.M. 9:20
Coal Eng.	A.M. 6:40															PM 11:					PM 11:			PM 6:30	AM 1:	PM 7:	AM 12:	
D.C. Arc Machine	P.M. 4:40	A.M. 6:	P.M. 5:	A.M. 1:	P.M. 6:	A.M. 5:	P.M. 6:	A.M. 6:	P.M. 4:50	A.M 6:	P.M. 4:50	A.M. 6:	P.M. 5:	A.M. 6:	P.M. 5	A.M 6:	P.M 5:	A.M. 6:	P.M 5:20	AM 6:	P.M. 5:40	A.M. 6:	P.M 5:20	AM 6:10	PM 5:40	A M 5:55	P.M 6:25	AM 5:50
D.C. 500 Volt	AM 6:30	PM 9:	AM 6:45	PM 10:	AM 6:10	PM 10:	A.M 6:	P.M. 9:	A.M 6:30	P.M 9:	A.M. 6:	P.M. 10:	AM 6:	P.M. 9:	A.M. 6:45	P.M. 10:	AM 6:30	P.M. 10	A.M. 6:30	P.M. 10:	AM 6:10	P.M. 7:	A.M 6:20	PM 9:15	A.M 6:15	P.M 8:15	AM 6:30	PM 9:20
A.C. 75 K.W.	AM 6													P.M 10:	A.M 6:15	P.M. 10:	A.M 6:30	P.M. 10:	A.M 6:30	P.M. 10:	A.M. 6:10	PM 7:	AM 6:20	PM 9:15	AM 6:15	PM 9:15	AM 6:30	PM 9:20
A.C. 45 K.W.													P.M 10:	AM 6:30	P.M. 10:	A.M 6:45	P.M. 10:	A.M 6:40	P.M. 10:	A.M. 6:30	PM 7:			AM 6:20	AM 5:40	PM 0:25	AM 6:30	PM 9:20
20 Amp Exciter													P.M 10:	A.M. 6:30	P.M. 10:	A.M. 6:45	PM 10:	A.M. 6:40	P.M. 10:	A.M. 6:30	PM 7:			AM 6:20	AM 5:40	PM 5:25	AM 6:30	PM 9:20
15 Amp Exciter	AM 6													P.M. 10:	A.M. 6:15	P.M 10:	A.M. 6:30	P.M 10:	A.M. 6:30	P.M. 10:	AM 6:10	PM 7:	AM 6:20	PM 9:15	AM 6:15	PM 9:15	AM 6:30	PM 9:20
Air Compressor	AM 6:20	PM 10	A.M. 6:20	P.M. 10:	A.M. 6 :	P.M. 9:	A.M. 8:	P.M. 9:	AM 8;	P.M. 10:	AM 1:	P.M. 7:	AM 12:30	PM 7:	AM 7:30	P.M. 7:	AM 6:50	P.M. 7:	AM 4:	P.M. 7:	AM 6:	PM 6:	AM 7:20	PM 6:20	AM 7:20	PM 6:30	AM 7:	PM 9:20
D.C Voltmeter		250		250		250		249		250		250		250		250		250		250		250		250		500		500
A.C. Voltmeter	AM 465	PM 462	AM 465	PM 463	AM 465	PM 460	AM 465	PM 462	AM 465	PM 460	AM 465	PM 463	AM 465	PM 463	AM 460	PM 465	AM 460	PM 463	AM 463	PM 460	AM 465	PM 464	AM 450	PM 463	AM 462	PM 458	AM 460	PM 455
D.C Ammeter								2		3		3		5		10		8		3		5		5		15		10
A.C. Ammeter	20	120	25	105	20	60	30	20	25	90	25	100	30	90	35	120	35	85	35	35	30	32	124	38	68	34	62	30
No Arc Lights on line	15	10	15	10	15	10	15	15	15	10	15	10	15	10	15	10	15	10	15	10	15	15	15	10	17	15	17	10
Arc Machine Amperes	9.6	8.8	9.8	9.7	9.8	9.7	9.8	9.8	9.6	9.8	9.6	9.8	9.6	9.7	9.8	9.8	9.5	9.8	9.8	9.8	9.8	9.7	9.6	9.6	9.7	9.6	9.6	9.5
Cylinder Oil.			5 3/4 gal.																									
Crank Case Oil									½ gal		4½ gal						6 gal.										3 gal.	
Engine Oil																												
Kerosine																												
Gasoline																												
Waste													6#										5#					
Labor hrs. Day	11		11		11		6		13		11		11		11		11		11		17		12		12		12	
Labor Night hrs.	12		12		12		24		12		12		12		12		12		12		6		11		11		11	

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ENGINE ROOM RECORD

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	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop
Westinghouse	PM 5:20	AM 6:40	PM 6:30	AM 6:10	PM. 4:30	AM. 5:20	PM 5:	AM 6:	PM 5:	AM 6:30	PM 8:	AM 6:	PM 5:	AM 6:30	PM 2:30	AM 6:30	PM 4:	AM 6:30	PM 4:30	AM 6:30	PM 6:30	AM 6:30	PM 9:30	AM 6:20	PM 9:30	AM 6:20	PM 6:20	AM 6:20
Ideal Comp	AM. 6:35	P.M. 9:15	AM 6:30	PM 10:40	AM 5:20	PM 8:	AM 5:50	PM 7:30	AM 6:20			PM 9:	AM 6:30	PM 9:	AM 6:30	PM 9:30	AM 6:30	PM 8:10	AM 6:30	PM 6:	AM 6:30	PM 9:	AM 6:20	PM 9:30	AM 2:15	PM 9:30	AM 6:20	PM 9:30
Ideal Simp	AM 7:55	AM 9:20			AM 8:10	PM 6:20			AM 7:40	PM 11:10	AM 5:	PM 8:	AM 7:30	PM 9:	AM 7:	PM 1:30	AM 7:	PM 7:	AM 6:30	PM 6:	AM 2:		AM 2:	PM 12	AM 6:20	PM 11:	AM 7:30	PM 7:
Coal Eng.		PM 8:20	AM 7:40	PM 7:20	AM 12	PM 6:30	AM 7:40	PM 8:	AM 7:	PM 6:	AM 8:	PM 7:	AM 6:	PM 8:	AM 9:15	PM 8:	AM 6	PM 8:	AM 1:	PM 6:			AM 6:30	PM 6:40			AM 7:	PM 0:
DC Arc Machine	PM 6:25	AM 5:45	PM 6:30	AM 6:		AM 5:20	PM 5:30	AM 6:55	PM 5:	AM 5:30	PM 5:30	AM 6:	PM 5:	AM 6:	PM 2:30	AM 6:55	PM 4:	AM 5:50	PM 4:30	AM 5:50	PM 6:30	AM 6:	PM 5:30	AM 6	PM 5:40	AM 6:	PM 5:40	AM 6:
D.C. 500 Volt	AM 6:35	PM 9:20	AM 6:50	PM 10:40	AM 5:20	PM 8:	AM 5:50	PM 7:30	AM 6:40			PM 9:	AM 6:30	PM 9:	AM 6:30	PM 9:30	AM 6:30	PM 8:10	AM 6:30	PM 7:	AM 6:30	PM 9:	AM 6:20	PM 9:30	AM 6:20	PM 9:30	AM 6:23	PM 9:30
A.C. 75 K.W.	AM 6:25	PM 9:20	AM 6:50	PM 10:40	AM. 5:20	P.M. 8:	AM 5:50	PM 7:30	AM 6:40			PM 9:	AM 6:30	PM 9:	AM 6:30	PM 9:30	AM 6:30	PM 8:10	AM 6:30	PM 7:	AM 6:30	PM 9:	AM 6:20	PM 9:30	AM 6:20	PM 9:30	AM 6:23	PM 9:30
AC 45 K.W.	AM 6:35	PM 9:20	AM 10:40	PM 6:50	AM 4:30	PM 5:20	PM 5:	AM 6:		AM 6:25	PM 9:		PM 9:	AM 6:30	PM 9:30	AM 6:30	PM 8:10	AM 6:30	PM 7:	AM 6:30	PM 9:		PM 9:30	AM 6:20	PM 9:30	AM 6:20	PM 9:30	AM 6:23
20 Amp Exciter	AM 6:35	PM 9:20	AM 10:40	PM 6:50	AM 4:30	PM 5:20	PM 5:	AM 6:		AM 6:25	PM 9:		PM 9:	AM 6:30	PM 9:30	AM 6:30	PM 8:10	AM 6:30	PM 7:	AM 6:30	PM 9:		PM 9:30	AM 6:20	PM 9:30	AM 6:20	PM 9:30	AM 6:23
15 Amp Exciter	AM 6:25	PM 9:20	AM 6:50	PM 10:40	AM 5:20	PM 8:	AM 5:50	PM 7:30	AM 6:40			PM 9:	AM 6:30	PM 9:	AM 6:30	PM 9:30	AM 6:30	PM 8:10	AM 6:30	PM 7:	AM 6:30	PM 9:	AM 6:20	P.M 9:30	AM 6:20	PM 9:30	AM 6:23	PM 9:30
Air Compressor	AM 7:55	PM 8:30	AM 6:50	PM 10:	AM 8:10	PM 6:			AM 7:40	PM 7:	AM 7:30	PM 9:	AM 7:	PM 5:	AM 7:	PM 7:	AM 6:30	AM 6:	AM 8:	PM 4:	PM 2:		AM 2:	PM 12:	PM 6:23	PM 11:	AM 7:30	PM 7:
D.C. Voltmeter	0	250	0	250	0	500	0	500	500	500	0	500	0	500	0	500	0	500	0	500	0	500	0	500	0	500	0	500
AC Voltmeter	AM 463	PM 450	AM 465	PM 450	AM 465	PM 450	AM 462	PM 460	AM 463	PM 466	AM 465	PM 466	AM 462	PM 460	AM 464	PM 466	AM 460	PM 466	AM 462	PM 465	AM	PM 460	AM 460	PM 464	AM 465	PM 464	AM 465	PM 466
D.C. Ammeter		10		10		10	0	3	0	10	0	6	0	10	0	8	0	6	0	5	0	4	0	5	0	5	0	8
AC Ammeter	30	96	34	88	35	76	20	25	37	76	35	66	95	66	95	86	34	85	95	128		20	40	120	25	140	34	160
No Arc Lights On Line	17	10	17	22	17	10	17	17	17	17	17	10	17	10	17	10	17	10	17	10		17	17	17	17	10	17	10
Arc Machine Amperes	9.8	9.6	9.8	8.8	9.7	9.8	9.6	9.7	9.8	9.7	9.8	9.8	9.6	9.8	9.8	9.8	9.6	9.8	9.7	9.6		9.6	9.6	9.8	9.8	9.6	9.6	9.7
Cylinder Oil	4 gal																		5 gal									
Crank Case Oil	5 gal																											
Engine Oil																							13 gal					
Kerosine																												
Gasoline																												
Waste																							7½ #					
Hrs Labor Day	12		12		12		6		11		11		11		11		11		11		12		12		12		12	
Hrs Labor Night	11		11		11		12		12		12		12		12		12		12		12		12		12		12	

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ENGINE ROOM RECORD

March 1902	6 Start	6 Stop	7 Start	7 Stop	8 Start	8 Stop	9 Start	9 Stop	10 Start	10 Stop	11 Start	11 Stop	12 Start	12 Stop	13 Start	13 Stop	14 Start	14 Stop	15 Start	15 Stop	16 Start	16 Stop	17 Start	17 Stop	18 Start	18 Stop	19 Start	19 Stop
Westinghouse	PM 6:30	AM 6:10	PM 9:30	AM 6:20	AM 6:20	PM 8:	PM 9:	AM 6:30	PM 9:30	AM 6:30	PM 9:30	AM 6:25	PM 9:30	AM 6:30	PM 9:30	AM 8:	PM 9:30	AM 6:20	PM 9:30	AM 6:20	PM 6:30	AM 6:	PM 6:	AM 6:45	PM 6:30	AM 6:30	PM 6:30	AM 9:	PM 6:30
Ideal Comp.	AM 6:10	PM 9:30	AM 6:20	PM 9:30	AM 6:25	PM 8:	AM 6:30	PM 9:	AM 6:20	PM 9:30	AM 6:25	PM 9:30	AM 6:30	PM 9:30	AM 6:20	PM 9:30	AM 6:20	AM PM 9:30	AM 6:30	PM 9:30	A M 6	PM 9	AM 6:30	AM 9:15	AM 6:30	PM 9:	AM 6:30	PM 9:
Ideal Simp.	AM 6:20	8:		8:	AM 7:	PM 11:			AM 6:45	PM 8:	AM 7:	PM 9:	AM 7:15	PM 10:	AM 7:	PM 9:	AM 6:40	AM 7:	AM 6:30	PM 11:	PM 11:	AM 1:30	AM 9:	AM 9:30	AM 8:	PM 6:45	AM 7:30	PM 6:30
Coal Eng.					AM 7:15	PM 7:					AM 6:30	PM 10:	AM 6:30							PM 10:	PM 7:							
DC Arc Machine	PM 5:15	AM 6:	PM 6:	AM 5:55	PM 7:33	AM 5:30	PM 6:	AM 6:	PM 6:30	AM 5:40	PM 4:45	AM 5:45	PM 4:35	AM 5:45	PM 6:30	AM 5:45	PM 6:30	AM 5:30	PM 4:45	AM 5:30		AM 5:30	PM 6:30	AM 5:30	PM 6:30	AM 5:30	PM 6:40	AM 5:45
DC 500 Volt	PM 9:30	AM 6:10	PM 9:30	AM 6:20	PM 9:30	AM 6:30	AM 6:30	PM 9:	AM 6:20	PM 9:30	AM 6:25	PM 9:30	AM 6:30	PM 9:30	AM 6:20	PM 9:30	AM 6:20	PM 9:30	AM 6:30	PM 9:30	AM 6:	PM 9:	AM 6:30	PM 9:15	AM 9:15	PM 6:30	AM 6:30	PM 9:
AC 75 K.W.	AM 6:10	PM 9:30	AM 6:20	PM 9:30	AM 6:30	PM 8:	AM 6:30	PM 9:	AM 6:20	PM 9:30	AM 6:25	PM 9:30	AM 6:30	PM 9:30	AM 6:20	PM 9:30	AM 6:20	PM 9:30	AM 6:30	PM 9:30	AM 6:	PM 9:	PM 6:30	AM 9:15	PM 9:15	AM 6:30	PM 6:30	AM 9:
AC 45 K.W.	PM 9:30	AM 6:10	PM 9:30	AM 6:20	PM 8:	AM 6:30	PM 9:	AM 6:30	PM 9:30	AM 6:20	PM 9:30	AM 6:25	PM 9:30	AM 6:30	PM 9:30	AM 6:20	PM 9:30	AM 6:20	PM 9:30	AM 6:30	PM 9:	AM 6	PM 9:15	AM 6:30	PM 9:	AM 6:30	PM 9:	AM 6:30
20 Amp Exciter	PM 9:30	AM 6:10	PM 9:30	AM 6:20	PM 8:	AM 6:30	PM 9:	AM 6:30	PM 9:30	AM 6:20	PM 9:30	AM 6:25	PM 9:30	AM 6:30	PM 9:30	AM 6:20	PM 9:30	AM 6:20	PM 9:30	AM 6:30	PM 9:	AM 6:	PM 9:15	AM 6:30	PM 9:	AM 6:30	PM 9:	AM 6:30
15 Amp Exciter	AM 6:10	PM 9:30	AM 6:20	PM 9:30	AM 6:30	PM 8:	AM 6:30	PM 9	AM 6:20	PM 9:30	AM 6:25	PM 9:30	AM 6:30	PM 9:30	AM 6:20	PM 9:30	AM 6:20	PM 9:30	AM 6:30	PM 9:30	AM 6:	PM 9:	AM 6:30	PM 9:15	AM 9:15	PM 6:30	AM 6:30	PM 9
Air Compressor	AM 6:30	PM 8:		PM 8:	AM 7:	PM 11:			AM 6:45	PM 8:	AM 7:	PM 9:	AM 7:15	PM 10:	AM 7:	PM 9:	AM 6:40	PM 7:	AM 6:30	PM 11:			AM 4:	PM 6:	PM 8:	AM 6:45	PM 7:30	AM 6:15
DC Voltmeter	0	500	0	500	0	500	0	500	0	500	0	500	0	500	0	500	0	500	0	500	0		0	500	0	500	0	500
AC Voltmeter	AM 464	PM 467	AM 464	PM 465	AM 465	PM 465	AM 465	PM 463	AM 465	PM 463	AM 465	PM 464	AM 465	PM 463	AM 465	PM 465	AM 465	PM 462	AM 465	PM 462	AM 465	PM	AM 463	PM 465	AM 462	PM 465	AM 465	PM 465
DC Ammeter	0	9	0	15	0	5	0	3	0	8	0	18	0	10	0	9	0	11	0	6	0	0	0	6	0	8	0	6
No Arc Lights	17	10	17	10	17	10	17	17	17	10	17	10	17	10	17	17	17	17	17	10	17	17	17	17	17	17	17	17
Arc Machine Amperes	9.7	9.8	9.6	9.8	9.9	9.7	9.8	9.7	9.8	9.8	9.6	9.7	9.8	9.8	9.6	9.7	9.8	9.6	9.8	9.9	9.8		9.7	9.8	9.5	9.1	9.8	9.5
A.C. Ammeter	30	169	30	165	30	130	25	20	20	110	25	120	25	110	35	100	34	80	30	98	20	0	30	86	32	38	36	30
Crank Case Oil			5 gal																								2½ gal	
Engine Oil																												
Kerosine																												
Gasoline																												
Waste													6#															
Hrs. Labor Day	12		12				11		11		11		11		11		11						11		11		11	
Hrs. Labor Night	12		12		12		12		12		12		12		12		12		12				12		12		12	
Cylinder Oil					8 gal																							

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ENGINE ROOM RECORD

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	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Westinghouse	PM 9:	AM 6:30	PM 8:	AM 6:30	PM 8:	AM 6:30	PM 7:30	AM 6:30	PM 9:35	AM 6:45	PM 9:30	AM 6:30	PM 9:30	AM 6:30	PM 10:	AM 6:35	PM 10:	AM 6:40	PM 9:40	AM 7:10	PM 7:30	AM 9:30	PM 9:40	AM 6:30	PM 9:30	AM 6:30	PM 9:20	AM 6:25
Ideal Comp	AM 6:30	PM 9:30	AM 6:30	PM 9:15	AM 6:30	PM 8:	AM 6:30	PM 7	AM 6:45	PM 9:30	AM 6:30	PM 9:30	AM 6:30	PM 9:30	AM 6:30	PM 10:	AM 5:30	PM 10	AM 6:45	PM 10:45		PM 7:30	AM 6:30	PM 9:40	AM 6:20	PM 9:50	AM 6:25	PM 9:30
Ideal Simp	AM 5:	PM 8:30	AM 6:15	PM 6:40	AM 6:30	PM 7:			AM 6:45	PM 8:	AM 5:30	PM 7:	AM 6:15	PM 7:	AM 6:30	PM 8:30	AM 6:15	PM 6:	AM 8:15	PM 10:45			AM 7:45	PM 6:15	AM 8:40	PM 6:15	AM 7:	PM 6:15
Coal Eng		PM 12					AM 6:30																AM 7:	PM 3:	AM 7:	PM 1:	AM 7:	PM 1:30
DC Arc Machine	PM 6:35	AM 5:40	PM 5:	AM 6:30	PM 6:35	AM 5:30	PM 7:30	AM 5:30	PM 7:	AM 5:30	PM 6:30	AM 5:30	PM 6:30	AM 5:30	PM 7:	AM 6:30	PM 7:	AM 5:40	PM 6:45	AM 5:45	PM 7:	AM 5:30	PM 6:40	AM 5:15	PM 6:40	AM 5:20	PM 6:30	AM 5:15
DC 500 Volt	AM 6:30	PM 9:30	AM 6:30	PM 8:20	AM 6:30	PM 8:	AM 6:30	PM 1:30	AM 6:45	PM 9:30	AM 9:30	PM 6:30	AM 9:30	PM 6:30	AM 9:30	PM 6:30	AM 10:	PM 6:30	AM 6:35	PM 9:40		PM 7:30	AM 6:40	PM 9:40	AM 6:30	PM 9:40	AM 6:25	PM 9:40
AC 75 KW	AM 6:30	PM 9:30	AM 6:30	PM 8:20	AM 6:30	PM 8	AM 6:30	PM 7:30	AM 6:45	PM 9:30	AM 9:30	PM 6:30	AM 9:30	PM 6:30	AM 9:30	PM 6:30	AM 10:	PM 6:30	AM 6:35	PM 9:40		PM 7:30	AM 6:20	PM 9:40	AM 6:30	PM 9:40	AM 6:25	PM 9:40
AC 45 KW	PM 9:30	AM 6:30	PM 8:20	AM 6:30	PM 8:30	AM 6:30	PM 7:30	AM 6:30	PM 9:30	AM 6:45	PM 9:30	AM 6:30	PM 9:30	AM 6:30	PM 10:	AM 6:30	PM 10:	AM 6:40	PM 9:40	AM 6:35	PM 7:30		PM 9:40	AM 6:20	PM 9:40	AM 6:20	PM 9:40	AM 6:25
20 Amp Exciter	PM 9:30	AM 6:30	PM 8:20	AM 6:30	PM 8:30	AM 6:30	PM 7:30	AM 6:30	PM 9:30	AM 6:45	PM 9:30	AM 6:30	PM 9:30	AM 6:30	PM 10:	AM 6:30	PM 10	AM 6:40	PM 9:40	AM 6:35	PM 7:30		PM 9:40	AM 6:20	PM 9:40	AM 6:20	PM 9:40	AM 6:25
15 Amp Exciter	AM 6:30	PM 9:30	AM 6:30	PM 8:20	AM 6:30	PM 8:	AM 6:30	PM 7:30	AM 6:45	PM 9:30	AM 9:30	PM 6:30	AM 9:30	PM 6:30	AM 9:30	PM 6:30	AM 10:	PM 6:30	AM 6:35	PM 9:40		PM 7:30	AM 6:20	PM 9:40	AM 6:30	PM 9:40	AM 6:25	PM 9:40
Air Compressor	AM 5	PM 6:30	AM 6:15	PM 6:40	AM 6:30	PM 7:			AM 6:45	PM 8:	AM 5:30	PM 7:	AM 6:30	PM 5:30	AM 6:	PM 6:	AM 6:30	PM 6:	AM 8:15	PM 10:45			AM 7:	PM 6:35	AM 8:40	PM 6:15	AM 7:	PM 6:15
DC Voltmeter	0	500	0	500	0	500	0	500	0	500	0	505	0	505	0	500	0	500	0	500	0		0	500	0	500	0	500
AC Voltmeter	AM 455	PM 465	AM 462	PM 465	AM 464	PM 460	AM 463	PM 460	AM 460	PM 460	AM 465	PM 465	AM 460	PM 460	AM 460	PM 460	AM 464	PM 464	AM 460	PM 460	AM 465	PM	AM 460	PM 464	AM 460	PM 460	AM 465	PM 460
DC Ammeter	0	6	0	5	0	5	0	2	0	5	0	14	0	15	0	5	0	10	0	8	0		0	9	0	10	0	8
AC Ammeter	35	44	36	48	44	35	25	10	30	80	30	80	30	90	30	85	35	54	32	48	20		37	95	36	100	35	106
No Arc Lights	17	17	17	17	17		17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	15	15	15	15	15
Arc Machine Amp.	9.9	9.6	9.8	9.7	9.6	9.7	9.6	9.5	9.6	9.6	9.8	9.8	9.4	9.6	9.5	9.5	9.9	9.8	9.8	9.9	10	9.6	9.4	9.6	9.8	9.6	9.9	9.6
Cylinder Oil			2½ gal								5 gal																5 gal	
Crank Case Oil																	5 gal										5 gal	
Engine Oil			10 gal																									
Kerosine																												
Gasoline																												
Waste	9#																		5#									
Hrs. Labor Day	11		11		11		12		12		12		12		3½						6		13		12		12	
Hrs Labor Night.	12		12		12		12		12		12		12		12		12		12		12		12		12		12	

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ENGINE ROOM RECORD

April 1902

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	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop	start	stop
Westinghouse	PM 11:35	AM 6:35		AM 6:33																								
Ideal Comp	AM 6:35	PM 11:35	AM 6:33	PM 5:30	AM 7:30	PM 7:	AM 9:	AM 7:	AM 7:30	AM 7:	AM 7:30	AM 6:30	AM 7:30	AM 6:20	AM 7:	AM 6:20	AM 7:15	AM 6:10	AM 7:15	AM 6:15			AM 5:45	AM 5:	AM 5:30	AM 5:	AM 2:1	AM 5:45
Ideal Simp	AM 6:45	PM 6:15	AM 6:30	PM 9		PM 6:15	AM 6:40	AM 9:	AM 6:30	AM 11:	AM 7:	AM 6:15	AM 7:	PM	AM 5:1	PM 7:	AM 6:10	PM 6:15	AM 6:15	PM 6:15			AM 5:	AM 5:45	AM 5	PM 6:	AM 3:40	PM 6:40
Coal Eng	AM 6:10	PM 1:	AM 7:	PM 12:	PM 6:40	PM 1:	AM 6:45	PM 2:	AM 6:30	PM 2:	AM	PM	AM	PM 1:		AM 5:		AM 1:	AM 2:30	PM 7:		AM 1:	AM 7:		PM 7:		AM 7:	PM 4:45
DC Arc Machine	PM 6:50	AM 5:15	PM 6:40	AM 5:10	PM 6:50	AM 5:10	PM 7:	AM 5:	PM 7:	AM 5:	PM 7:	AM 5:	PM 7:	AM 5:	PM 7:	AM 5:	PM 7:	AM 4:40	PM 7:05	AM 4:45	PM 7:10	AM 4:40	PM 7:	AM 4:45	PM 7:10	AM 5:	PM 7:15	AM 4:50
DC 500 Volt	AM 6:35	PM 11:35	AM 6:33																		PM 7:10	AM 4:40	PM 7:	AM 4:45	PM 7:10	AM 5:	PM 7:15	AM 4:50
AC 75 KW	AM 6:35	PM 11:35	AM 6:33																		PM 7:10	AM 4:40	PM 7	AM 4:45	PM 7:10	AM 5	PM 7:15	AM 4:50
AC 75 KW	PM 11:35	AM 6:35		AM 6:35																			AM 5:15	AM 5:45	AM 5:	PM 6:	AM 7:	PM 6:40
20 Amp Exciter	PM 11:35	AM 6:35		AM 6:35																								
15 Amp Exciter	AM 6:35	PM 11:35	AM 6:35																		PM 7:10	AM 4:40	PM 7:05	AM 4:45	PM 7:10	AM 5:	PM 7:15	AM 4:30
Air Compressor	AM 6:40	PM 6:15	AM 6:30	PM 9:	AM 6:40	PM 6:15					PM 4:	PM 7:			AM 6:10	PM 7:30	AM 6:10	PM 6:15	AM 6:15	PM 6:15			AM 5:15	AM 5:45	AM 5:	PM 6:	AM 7:	PM 6:40
DC Voltmeter	0	300	0	308	0	300	500	500	500	500	500	500	0	500	500	525	520	500	500	520	500	500	500	500	500	510	500	500
AC Voltmeter	AM 463	PM 460	AM 460	PM 460	AM 463	PM 468	AM 460	PM 463	AM 460	PM 500	AM 460	PM 463	AM 460	PM 465	AM 460	PM 450	AM 460	PM 456	AM 460	PM 464	AM 460	PM 465	AM 465	PM 460	AM 464	PM 465	AM 462	PM 460
DC Ammeter	0	7	0	6	0	6	0	0	.	10	2.0	10.5	0	10.0	3.5	7.5	3.7	9.5	3.5	8.0	0		3	11	.3	12	.3	10
AC Ammeter	35	85	36	83	37	95	20		25	95	20	105	30	100	0	73	30	75	30	30	15		28	90	22	12	26	22
No Arc Lights	15	13	15	15	15	15	15	15	15	15	13	13	13	13	13	13	13	13	13	13	15	15	13	13	15	15	15	15
Arc Machine Amp	9.8	9.8	9.7	9.4	9.6	9.6	9.8	9.8	9.8	9.6	9.7	9.4	9.8	9.4	9.8	7.8	7.8	9.8	10.	9.4	9.1	9.6	9.8	9.7	9.8	9.4	9.6	9.7
Cylinder Oil													5 gal										5 gal					
Crank Case Oil																												
Engine Oil																												
Kerosine																												
Gasoline																												
Waste	3#								1#												9½#							
Hrs Labor Day	11		11		11		1		11½		11		11		11		11		11				11		11		11	
Hrs Labor Night	12		12		12		12		12		12		12		12		12		12		12		12		12		12	

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ENGINE ROOM RECORD

April 1902

	17		18		19		20		21		22		23		24		25		26		27		28		29		30	
	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Westinghouse											AM 7:10	PM 12:30	AM 6:10	PM 4:20	AM 6:50	PM 5:	AM 6:30	PM 6:			PM 7:30	AM 5:40	PM 7:30	AM 5:40	PM 7:30	AM 5:40	7:	5:36
Ideal comp.	AM 4:15	AM 3:30	AM 4:45	AM 4:	AM 4:30	AM 4:	AM 5:20	AM 4:30	AM 6:10	AM 4:20	AM 3:	AM 4:20	AM 4:	AM 4:40	AM 5:	AM 3:30	AM 5:	AM 4:30	AM 5:	AM 4:30	AM 4	AM 5:	AM 5:30	AM 4:15	AM 5:40	AM 4:30	AM 5:30	AM 4:30
Ideal Simp.	AM 4:15	AM 3:30	AM 6:20	PM 6:30	AM 6:30	PM 6:30	AM 5:15		AM 6:30	PM 6:30	AM 6:45	PM 4:30	AM 7:15	PM 6:	AM 7:45	PM 6:30	AM 6:	PM 6:30	AM 6:40	PM 6:20			AM 7:	PM 5:45	AM 7:	PM 7:	AM 6:30	PM 6:
Coal Eng		AM 1:	AM 7:	PM 4'	AM 7:	PM 3:	AM 6:	PM 5'	AM C:	PM C:	AM 6:30	PM C:	AM C:30	PM 7:40	AM 6:36	PM 7:	AM 7:45	PM 6:30	AM 7:	PM 6:20			AM 7:15	PM 6:	AM 7:	PM 6:	AM 7:30	PM 6'
DC Arc Machine	PM 7:10	AM 5:15	PM 7:15	AM 4:30	PM 7:10	AM 4:30	PM 7:10	AM 4:30	PM 8:30	AM 4:	PM 4:	AM 7:30	PM 7:15	AM 4:20	PM 7:20	AM 4:	AM 7:20	PM 4:40	AM 7:20	PM 4:30	PM 7:30	AM 4:45	PM 7:30	AM 4.15	PM 7.30	AM 4:	PM 7:30	AM 4:
DC 500 Volt	PM 7:10	AM 5:15	PM 7:15	AM 4:30	PM 7:10	AM 4:30	PM 7:10	AM 4:30	PM 8:30	AM 4:	PM 4:	AM 7:30	PM 7:15	AM 4:20	PM 7:20	AM 4:	AM 7:20	PM 4:40	AM 7:20	PM 4:30								
AC 75 K.W.	PM 7:10	AM 5:15	PM 7:15	AM 4:30	PM 7:10	AM 4:30	PM 7:10	AM 4:30	PM 8:30	AM 4:	PM 4:	AM 7:30	PM 7:15	AM 4:20	PM 7:20	AM 4:	AM 7:20	PM 4:40	AM 7:20	PM 4:30								
AC 45 KW																												
20 Amp. Exciter																												
15 Amp Exciter	PM 7:10	AM 5:15	PM 7:15	AM 4:30	PM 7:10	AM 4:30	PM 7:10	AM 4:30	PM 8:30	AM 4:	PM 4:	AM 7:30	PM 7:15	AM 4:20	PM 7:20	AM 4:	AM 7:20	PM 4:40	AM 7:20	PM 4:30								
Air Compressor	AM 7:	PM 11:	AM 6:15	PM 7:20	AM 6:30	PM 6:30			AM 6:30	PM 6:30	AM 6:45	PM 6:40	AM 7:15	PM 6:	AM 6:	PM 7:45	AM 6:30	PM 6:30	AM 6:40	PM 6:20			AM 7:	PM 5:45	AM 7:	PM 7:	PM 7:	AM 6:30
DC Voltmeter	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	505	500	505	500	505	500	500
AC Voltmeter	AM 464	PM 460	AM 465	PM 460	AM 463	PM 460	AM 465	PM 465	AM 465	PM 460	AM 463	PM 460	AM 464	PM 465	AM 464	PM 465	AM 463	PM 465	AM 464	PM 465	AM 465	PM 465	AM 465	PM 465	AM 465	PM 465	AM 465	PM 465
DC Ammeter	3	11	3	11	3	10	3	3	3	11	3	4	2	7	3	4	3	6	3	4	3	3	0	3	0	11	0	9
AC Ammeter	22	84	20	120	20	75	20	20	22	86	20	30	20	82	22	84	20	90	20	42	20	10	20	96	25	78	30	82
No Arc Lights	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Arc Machine Amperes	9.7	9.6	9.5	9.5	9.6	9.6	9.7	9.6	9.8	9.7	9.8	9.4	9.6	9.7	9.7	9.6	9.7	9.7	9.8	9.8	9.9	9.6	9.6	9.7	9.6	9.6	9.6	9.6
Cylinder Oil	4 gal																		7 gal									
Crank Case Oil	2 gal		4 gal												4 gal				4 gal									
Engine Oil							15 gal																					
Kerosine																									4 gal			
Gasoline																												
Waste															4½ #								8 #					
Hrs Labor Day	11		11		11		11		11		11		11		11		11		11									
Hrs Labor Night	12		12		12		12		12		12		12		12		12		12									

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BOILER ROOM RECORD

FEB 1902	6 Start	6 Stop	7 start	7 Stop	8 start	8 Stop	9 start	9 stop	10 start	10 Stop	11 start	11 Stop	12 start	12 Stop	13 start	13 Stop	14 start	14 Stop	15 start	15 Stop	16 Start	16 Stop	17 start	17 Stop	18 start	18 Stop	19 start	19 Stop
Boiler No 1																												
.. .. 2	PM 11.30	PM 9:							PM 3:								AM 1:											
.. .. 3											AM 3:	PM 5:	AM 2:30	PM 4:30														
.. .. 4	on																											
.. .. 5	PM 9:	PM 1:							PM 3:	AM 2:	PM 5:	AM 2:30	PM 5:				AM 9:30	PM 5:	AM 9:	PM 3:			AM 2:	PM 5:	AM 3:	PM 3:	AM 2:	PM 5:
.. .. 6	PM 11.30	PM 5:							PM 5:	AM 2:				PM 5:	AM 2:30	PM 4:30	AM 3:	PM 5:	AM 9:	PM 3:	AM 3:		AM 2:	PM 5:	AM 3:	PM 5:	AM 2:	PM 5:
Feed Pump	on																											
Fire ..	on																											
Pressure ..	on																											
Wind 6 AM Direct	S	amt calm	N	AMT Calm	W	Amt Calm	W	Amt Calm	W	Amt Calm	W	Amt Calm	W	Amt Calm	N	Amt Calm	NE	Amt Calm	NE	Amt Calm	NW	Amt Calm	NW	Amt calm	NW	Amt Calm	E	Amt Calm
Wind 6 PM	W	Calm	NW	Calm	W	Calm	W	Calm	W	Calm	SW	Calm	NW	calm	NE	Calm	NE	Calm	NE	Calm	W	Calm	W	Calm	W	Calm	NE	Calm
Temperature Feed water Outside	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM
	20	28	24	0	12	14	-2	11	9	-3		24	14	24	24	14	23	22	5	22	18	6	26	22	6	19	18	1	24	26	12	28	24	20	25	22	4	20	18	6	24	18
Temperature Inside	54	57	52	53	58	69	54	60	57	52		64	58	58	58	54	67	66	62	64	68	53	65	67	55	58	58	60	68	68	66	52	58	64	65	64	55	65	64	63	56	72
Weather 6 AM	Cloudy		Clear		Clear		Clear		Cloudy		Cloudy		Clear		Clear		Clear		Clear		Cloudy		Cloudy		Clear		Clear	
Weather 6 PM.	Clear		clear		Clear		Clear		Cloudy		Cloudy		Clear		Clear		Clear		Clear		Cloudy		Cloudy		Clear		Clear	
Draft at 12 M	.6		.6		.5		.6		.6		.5		.6		.6		.5		5		.5		.5		.5		.55	
Water Meter 6 AM	169536		177666		187399		197051		206664		214507		223451		231354		239331		248100		256118		262452		27468		278046	
Water Meter 6 PM	174192		182330		192229		201805		211271		219109		228325		236370		244474		253666		259410		267160		275130		282065	
Pounds Water Night	206946		301960		287604		283675		198726		258653		180431		193424		251743		146065		243782		197311		113706		223543	
Pounds Water Day	277348		277824		287723		282628		274429		233711		284568		299994		288321		290049		327184		285210		277586		202981	
HP Night PER Hour	544		795		757		747		523		681		475		509		662		387		641		519		457		588	
HP Day Per Hour	730		755		757		744		722		879		749		798		759		673		871		751		731		536	
Tons Coal	40.358		48.315		47.944		47.208		39.438		49.364		38.661		41.118		45.005		36.342		47.630		40.210		37.609		35.544	
Cylinder Oil			1gal						1gal						1gal								1gal				1gal	
Lard Oil																												
Machine Oil									1gal														1gal					
Waste			8.4#														6#										9#	
Hrs Labor Day	72		73		73		34		73		75		74		73		75		73		32		75		75		73	
Hrs Labor Night	24		24		12		24		24		24		24		24		24		24		24		12		12		12	

BOILER ROOM RECORD

FEB 1902	20 Start	20 Stop	21 Start	21 Stop	22 Start	22 Stop	23 Start	23 Stop	24 Start	24 Stop	25 Start	25 Stop	26 Start	26 Stop	27 Start	27 Stop	28 Start	28 Stop	March 1 Start	1 Stop	2 Start	2 Stop	3 Start	3 Stop	4 Start	4 Stop	5 Start	5 Stop
Boiler No 1						PM 8:			PM 4:	AM 10:	PM 3:	AM 9:	PM 3:	AM 9:	PM 3:	AM 9:	PM 4:	AM 5:	PM 4:	AM 4:	PM 8:	AM 10:30	PM 4	M 12	PM 4:	AM 7		
" " 2	ON																											
" " 3																												
" " 4	ON																											
" " 5	PM 1:	PM 5:	PM 9:30		PM 5:	AM 6:	AM 7:30		M 12	PM 4:	AM 4:	PM 3:30	AM 4:	PM 3:	AM 5:	PM 3:	AM 5:	PM 4:	AM 4:	PM 5:	AM 10:30			PM 4:	AM 4:	PM 4:30	AM 3:	PM 4:
" " 6	AM 2:	PM 5:	AM 3:30		PM 5:	AM 6:	AM 7:30		M 12:	PM 4:	AM 4:	P:M 3:30	AM 4:	P.M 3:	AM 5	PM 3:	AM 5:	PM 4:	AM 4:	PM 5:	PM 7:			PM 4:	AM 4:	PM 4:30	AM 3:	PM 4:
Feed Pump	ON																											
Fire "	ON																											
Pressure	ON																											
Wind 6 AM	Dir. NW	Amt. Calm	Dir. NW	Amt. Calm	Dir. NW	Amt. Calm	Dir E	Amt Calm	Dir E	Amt Calm	Dir NE	Amt Calm	Dir S	Amt Calm	Dir SE	Amt Calm	Dir S	Amt Calm	Dir W	Amt Calm	Dir N	Amt Calm	Dir W	Amt Calm	Dir NE	Amt High	Dir N	Amt High
Wind 6 PM	W	Calm	W	Calm	W	Calm	NE	Calm	NE	Calm	N	Calm	SE	Calm	SE	Calm	S W	Calm	W	High	NW	Calm	E	Calm	NE	High	NW	Light
Temperature Feed Outside	6AM 8	M 27	6PM 25	6AM 5	M 27	6PM 29	6AM 14	M 36	6AM 32	M 28	6PM 35	M 47	6PM 46	6AM 36	M 28	6PM 42	6AM 39	M 42	6PM 45	M 45	6PM 47	6AM 46	M 48	6PM 43	6AM 42	M 40	6PM 32	6AM 32	M 30	6PM 24	6AM 26	M 28	6PM 27	6AM 32	M 31	6PM 29	6AM 34	M 32	6PM 27	6AM 39	M 38	6PM
Inside Temp.	72	62	67	50	70	72	58	67	72	65	60	60	62	70	64	64	67	68	75	64	80	70	64	73	59	55	58	64	54	74	74	75	74	66	68	70	69	65	63	74	72
Weather 6 AM	Cloudy		Cloudy		Clear		Clear		Clear		Clear		Rain		Rain		Snow		Cloudy		Cloudy		Cloudy		Cloudy		Clear	
Weather 6 PM	Cloudy		Clear		Clear		Cloudy		Clear		Cloudy		Rain		Rain		Snow		Cloudy		Cloudy		Cloudy		Clear		Clear	
Draft at 6 PM	.6		.6		.55				.5		.6		.55		.6		.5		.6		.5		.55		.6		.6	
water Meter 6AM	286491		294432		302368		308453		313930		320650		327235		333672		339851		346196		352773		359318		366373		374162	
water Meter 6PM	291046		299057		306390		310861		318190		324516		331229		337485		343795		350316		355475		363743		371210		378568	
Pounds Water Night	171017		167228		104195		154753		124145		137327		123893		123640		121266		124094		194602		117688		149096		126042	
Pounds water Day	230058		232896		203139		121620		265767		194259		337029		142682		199198		208089		136469		223492		234200		222393	
HP Night	441		413		274		407		327		347		326		325		319		327		512		310		392		331	
HP DAY	657		625		535		320		699		511		892		483		524		548		358		387		616		586	
Tons Coal	33.431		33.344		25.611		23.031		32.499		27.729		38.511		26.293		26.705		27.682		25.921		29.181		31.941		29.053	
Cylinder Oil											1 gal						1 gal						1 gal				1 gal	
Lard Oil																												
Machine Oil													1 gal						1 gal									
Waste															6#													
Hrs Labor Day	73		79		69		24		62		53		63		63		63		63		43		63		63		63	
Hrs Labor Night	12		12		12		24		24		24		24		24		24		24		24		24		24		24	

March 1902	
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BOILER ROOM RECORD

March 1902	6 Start	6 Stop	7 Start	7 Stop	8 Start	8 Stop	9 Start	9 Stop	10 Start	10 Stop	11 Start	11 Stop	12 Start	12 Stop	13 Start	13 Stop	14 Start	14 Stop	15 Start	15 Stop	16 Start	16 Stop	17 Start	17 Stop	18 Start	18 Stop	19 Start	19 Stop
Boiler No 1																							PM 9:			AM 8:		
.. .. 2							AM 6:	PM 1:30	AM 4:30									PM 1:	AM 4:									
.. .. 3	AM 7:	AM 10:	AM 5:	AM 9:	AM 5:	PM 2:																	AM 9:			AM 10:		
.. .. 4	on							AM 10:											PM 130	AM 7:								
.. .. 5	AM 2:	PM 2:	AM 3:	PM 5:	AM 5:	PM 3:	AM 10:			AM 11:																		
.. .. 6											AM 5:	PM 2:	AM 3:	AM 5:	AM 3	PM 1:	AM 4:	AM 11:	AM 4:30	PM 3:			AM 2:			PM 5:	AM 3:	PM 4:
Feed Pump	on																											
Fire ..	on																											
Pressure..	on																											
Wind 6AM	Dir SW	Amt calm	Dir SE	Amt calm	Dir NW	Amt Calm	Dir SW	Amt Calm	Dir SE	Amt Calm	Dir S	Amt Calm	Dir S	Amt Calm	Dir W	Amt Calm	Dir SE	Amt Calm	Dir SE	Amt High	Dir W	Amt calm	Dir W	Amt High	Dir N	Amt Calm	Dir SE	Amt Calm
Wind 6PM	S	calm	E	Calm	NW	Calm	S	Calm	SE	Calm	E	Calm	W	High	SW	Calm	SE	Calm	W	Calm	W	High	NW	High	S	Calm	SE	Calm
Temperature																												
Feed water Outside	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM
Temperature	31	47	41	34	46	41	38	42	43	40	55	45	40	63	67	36	60	58	58	62	42	35	50	50	34	58	52	50	55	58	39	40	30	16	14	12	11	27	30	23	40	40
Inside Temperature	63	65	68	68	62	64	70	66	70	76	72	70	66	72	74	73	66	66	65	70	54	72	64	64	74	68	62	68	68	60	72	60	58	58	51	50	62	72	66	58	66	58
Weather at 6 AM	Clear		Clear		Cloudy		Cloudy		Cloudy		Cloudy		Cloudy		Foggy		Clear		Cloudy		Clear		Clear		Clear		Clear	
Weather at 6 PM	Clear		Rain		Cloudy		Cloudy		Clear		Rain		Rain		Clear		Clear		Rain		Clear		Clear		Clear		Cloudy	
Draft at 12 M	.6		.55		.5		.5		.5		.45		.5		.45		.45		.5		.6		.6		.6		.5	
Water Meter 6 AM	381063		386887		392865		398511		402590		408411		413203		417836		422627		7AM 432211		438433		447371		452063		460453	
Water Meter 6 PM	384517		390433		396368		400425		405455		410788		415685		420441		428151		435906		7PM 440798		448093		457333		464352	
Pounds Water Night	119701		122832		128580		118608		205873		144019		233561		201918		223267		144600		180680		236500		185850		117750	
Pounds Water Day	174450		298799		176925		174017		170817		111811		139641		254186		186096		220110		124152		63140		314720		232250	
HP Night	315		320		404		310		541		379		614		531		559		380		1052 ?		662		489		473	
HP Day	459		786		468		300		445		294		420		669		492		517		326		116 ?		827		611	
Tons Coal	24.512		35.134		25.421		19.39		31.39		21.32		31.10		35.00		3411		30.40		10.116		21.635		41.685		42.60	
Cylinder Oil					1 gal										½ gal		1 gal						1 gal					
Lard Oil																												
Machine Oil	1 gal																1 gal											
Waste	37 #										8 #												5.5 #					
Hrs Labor Day	63		63		56		30		62		73		71		74		78		75		38		74		54		75	
Hrs. Labor Night	24		24		24		24		24		24		24		24		24		24		24		35		24		24	

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Tons Coal

Cylinder
Oil

Lard
Oil

Machine
Oil

Waste

Hrs Labor
Day

Hrs Labor
Night

BOILER ROOM RECORD

March 1902	20 Start	20 Stop	21 Start	21 Stop	22 Start	22 Stop	23 Start	23 Stop	24 Start	24 Stop	25 Start	25 Stop	26 Start	26 Stop	27 Start	27 Stop	28 Start	28 Stop	29 Start	29 Stop	30 Start	30 Stop	31 Start	31 Stop	April 1 Start	April 1 Stop	2 Start	2 Stop
Boiler No 1																												
" " 2	on								AM 9:30	AM 4:					AM 4:													
" " 3																												
" " 4	on			AM 4:					AM 4:						AM 11:	AM 4:				AM 11:			AM 4:	PM 5:	AM 4:	PM 5:	AM 4:	
" " 5			AM 4:		M 12								AM 4:						AM 10:	AM 8:								
" " 6	AM 4:30	PM 2		PM 4:	AM 4:					AM 11:	AM 5:	AM 11:				AM 9:			AM 4:	AM 9:30	AM 5'							PM 4:
Feed Pump	on																											
Fire "	on																											
Pressure "	on																											
Wind 6 AM	Dir SE	Amt Calm	Dir E	Amt Calm	Dir N	Amt Calm	Dir	Amt	Dir	Amt	Dir	Amt	Dir	Amt	Dir	Amt	Dir	Amt	Dir	Amt	Dir NW	Amt High	Dir W	Amt High	Dir W	Amt Calm	Dir W	Amt Calm
Wind 6 PM	E	Calm	E	Calm	N	Calm															NW	High	W	High	NW	Calm	NW	Calm
Temperature Outside 6 AM	36	54	38	48	38	56	40	60	58	43	62	60	40	66	64	60	58	64	57	69	65	67	64	56	46	62	56	37
Temperature Outside 6 PM	50	43	48	56	51	68	60	58	43	62	60	40	66	64	60	58	64	57	69	65	67	64	56	46	62	56	37	46
Temperature Inside 6 AM	62	56	58	56	68	62	68	68	72	70	59	72	68	54	72	74	76	66	71	57	70	70	62	66	62	56	64	62
Temperature Inside 6 PM	58	56	58	56	68	62	68	68	72	70	59	72	68	54	72	74	76	66	71	57	70	70	62	66	62	56	64	62
Weather 6 AM	Cloudy		Cloudy		Cloudy		Cloudy		Cloudy		Clear		Cloudy		Clear		Rain		Clear		Cloudy		Cloudy		Snow		Clear	
Weather 6 PM	Clear		Rain		Clear		Clear		Clear		Clear		Cloudy		Clear		Cloudy		Rain		Clear		Cloudy		Cloudy		Clear	
Draft at 12 M	.5		.5		.4		.3		.4		.5		.4		.5		.4		.5		.6		.6		.65		.7	
Water Meter 6 AM	467369		473971		479709		484199		489438		493440		498694		503817		508667		513375		517928		522343		529204		533583	
Water Meter 6 PM	470951		477458		482699		486510		491460		496364		501716		506490		511351		516005		519997		526696		533862		539559	
Pounds Water Night	179950		131050		123097		174590		117943		138798		125156		125483		121384		114553		139055		149471		102520		139453	
Pounds Water Day	213400		207700		174050		101924		120450		174182		150020		153869		154455		155471		123250		259308		277477		151326	
HP Night	474		344		325		459		310		365		325		330		319		276		376		393		296		361	
HP Day	561		546		408		268		311		458		474		405		406		409		223		683		731		414	
Tons Coal	32.94		28.28		24.93		23.028		17.866		26.081		23.431		23.296		22.974		22.50		21.858		34.065		31.666		24.731	
Cylinder Oil	1gal								1gal														1gal					
Lard Oil																												
Machine Oil	1gal																		1gal									
Waste					5.2#														5#									
Hrs Labor Day	74		75		75		28		74		74		63		64		15		75		30		55		53		52	
Hrs Labor Night	24		24		24		24		24		24		24		24		24		24		24		24		24		24	

BOILER ROOM RECORD

April 1902	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Boiler No 1														
" " 2								AM 5:						
" " 3										AM 5:30 AM 9:		AM 5: PM 3:		
" " 4	on	PM 4: / AM 4: PM 2: AM 5: AM 11:			AM 5: PM 5: AM 4: PM 5: AM 4:			AM 9:30 AM 5: PM 2		AM 5:	AM 9:	PM 7:	PM 2: AM 5:30	PM 10:
" " 5	on													
" " 6	on			AM 10: PM 9:			AM 11:						AM 5:	
Feed Pump	on													
Fire Pump	on													
Pressure	on													

	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM	6AM	6PM
Wind Dir	SE		Calm		N		Calm		SW		Calm		W		Calm		NW		Calm		N		Calm		Light		NW		Calm		N	
Wind Amt		NE		Calm		N		Calm		SE		Calm		W		Calm		N		Calm		N		Calm		N		Calm		NW		N
Temperature Feed Outside	28	30	46	30	52	50	34	60	52	45	64	58	34	32	30	28	41	43	60	63	46	68	65	44	60	56	38	38	33	32	36	36
Temperature Inside	57	64	65	58	59	62	62	72	64	70	70	70	65	60	59	68	64	60	68	70	66	72	68	65	65	65	64	66	60	58	69	65
Weather 6AM	Clear		Clear		Clear		Cloudy		Clear		Cloudy		Clear		Clear		Clear		Clear		Clear		Clear		Clear		Clear		Clear	
Weather 6PM	Cloudy		Clear		Cloudy		Clear		Cloudy		Clear		Clear		Clear		Clear		Clear		Clear		Clear		Clear		Clear		Cloudy	
Draft at 12M	.6		.6		.6		.6		.6		.6		.7		.65		.7		.6		6		.5		.7		6			
Water Meter 6AM	541900		547522		553469		558420		562250		568540		574690		579030		584179		590543		595651		599898		603438		611060			
Water Meter 6PM	545222		550000		556270		560350		566140		571871		577364		582650		587862		593500		597602		603571		608610		613756			
Pounds water Night	137011		206648		128065		113203		142968		167927		139343		126824		159707		128492		136772		110025		145946		91206			
Pounds water Day	147891		146044		166806		113970		231727		198427		159290		173743		173754		173148		116221		219992		178976		172514			
HP Night	360		338		316		296		374		439		365		332		418		337		359		289		383		240			
HP DAY	389		391		434		298		601		519		411		460		392		461		305		578		460		456			
Tons Coal	23.743		29.391		24.512		18.931		31.224		30.529		24.886		25.205		29.263		25.388		21.083		25.833		27.077		21.977			
Cylinder Oil									1gal						1gal						1gal									
Larol Oil																														
Machine Oil			1gal																		1gal									
Waste									11#																					
Hrs Labor Day	67		64		62		38		66		62		64		53		55		63		30		55		53		53			
Hrs Labor Night	24		24		24		24		24		24		24		24		24		24		24		24		24		24			

BOILER ROOM RECORD.

April 1902	17 Start	17 Stop	18 Start	18 Stop	19 Start	19 Stop	20 Start	20 Stop	21 Start	21 Stop	22 Start	22 Stop	23 Start	23 Stop	24 Start	24 Stop	25 Start	25 Stop	26 Start	26 Stop	27 Start	27 Stop	28 Start	28 Stop	29 Start	29 Stop	30 Start	30 Stop
Boiler No 1	AM 5:30	PM 9:	AM 5:	PM 10:	AM 5:30	AM 9:			AM 5:30	AM 8:	AM 5:						AM 10:	AM 5:10										
.. .. 2																							AM 6:		PM 9:	AM 6:	PM 9:	
.. .. 3																												
.. .. 4																												
.. .. 5	on					PM 3:30	AM 5:30						PM 3:	AM 5:					AM 8:	AM 5:	PM 3:	AM 6:				AM 10:30	6AM	PM 11:
.. .. 6	AM 9:	PM 3:	AM 5:	AM 9:	AM 5:30						AM 6:30	AM 5:											AM 6:	AM 6:	AM 111	AM 6:		AM 9:
Feed Pump	on																											
Fire ..	on																											
Pressure	on																											
Wind 6AM	Dir W	Amt Calm	Dir NE	Amt Calm	Dir E	Amt calm	Dir W	Amt Calm	Dir SE	Amt Calm	Dir S	Amt Calm	Dir W	Amt High	Dir N	Amt Calm	Dir E	Amt Light	Dir W	Amt High	Dir W	Amt Calm	Dir SE	Amt Calm	Dir W	Amt Calm	Dir E	Amt Calm
Wind 6PM	E	Calm	E	Calm	E	Calm	W	Calm	SW	Calm	SW	High	W	Calm	SE	Calm	SW	High	NW	High	S	Calm	SE	Calm	W	Calm	E	Calm
Temperature Feed water																												
Outside	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM	6AM	M	6PM
Temp.	45	65	63	47	63	56	45	51	53	40	52	54	58	85	80	65	81	56	41	54	63	44	66	64	56	82	78	48	56	54	44	75	74	56	64	60	56		76	59	68	72
Inside Temp.	59	68	74	56	72	63	58	64	66	67	62	68	69	89	84	70	83	76	64	64	66	77	68	76	75	84	73	72	66	72	66	75	70	70	70	66	66		76	66	70	74
Weather 6AM	clear		clear		cloudy		clear		cloudy		clear		clear		clear		cloudy		clear		clear		Rain		cloudy		clear	
Weather 6PM	clear		Rain		cloudy		clear		clear		Rainy		clear		cloudy		cloudy		clear		clear		cloudy		clear		clear	
Draft at 12M	.5		.6		.6		.7		.7		.5		.7		.6		.5		.7		.5		.5		.6		.6	
Water Meter 6AM	615481		620704		625226		630553		634584		639693		644504		649815		654610		659060		664493		667760		671676		675562	
Water Meter 6PM	618703		623211		628209		632456		637320		642099		647196		652570		657030		662388		665992		669956		673873		677758	
Pounds Water Night	115239		149174		139532		126764		141478		145645		121171		122421		144684		113480		103319		103460		101209		104511	
Pounds Water Day	191377		148341		177697		113361		161983		145586		196104		166115		144159		210162		89295		130805		130279		130815	
HP Night	303		392		366		333		371		383		315		321		380		298		271		269		271		275	
HP Day	533		390		467		298		325		382		515		421		379		432		235		344		342		343	
Tons Coal	25.568		24.876		26.435		20.010		25.288		24.269		21.273		23.544		24.070		26.97									
Cylinder Oil			1gal						2gal										1gal						1gal			
Lard Oil																												
Machine Oil													1gal												1gal			
Waste			8#																6.5#									
Hrs Labor Day	53		63		73		24		68		63		54		53		62		64		36		53		53		58	
Hrs Labor Night	24		24		24		24		24		24		23		24		24		24		24		24		24		24	

General Summary of Results of entire Test

*Summary for Month of February

Total expense for month.	$1905.51
Average H.P. per hour	594
.. total cost per day of 24 hours	$82.87
.. consumption of coal per 24 hours tons	37.
.. cost of coal per day of 24 hours	51.06
.. number hours labor per 24 hours	85
.. cost of labor per day of 24 hours	$15.69

Summary for month of March.

Total expense for month	$2284.18
Average H. P. per hour	453
.. total cost per day of 24 hours	$ 73.68
.. consumption of coal per day of 24 hours	29. 5
.. cost of coal per day of 24 hours	$39.72
.. number hours labor per day of 24 hours	87
.. cost of labor per day of 24 hours	$17.02

Summary for month of April

Total expense for month	$2015.69
Average H.P. per hour	384
.. total cost per day of 24 hours	$ 68.83
.. consumption of coal per day of 24 hours	23.7
.. cost of coal per day of 24 hours	$32.69
.. number hours labor per day of 24 hours	81
.. cost of labor per day of 24 hours	$14.84

* Readings began on Feb. 6.

Averages of Results of three months test.

Average H P per hour	477
.. total cost per day of 24 hours	75.12
.. cost per H P per hour per day of 24 hrs.	$0.159
.. consumption of coal per day of 24 hours.	30
.. cost of coal per day of 24 hours	41.40
.. number hours labor per day of 24 hours.	84
.. cost of labor per day of 24 hours	$15.85
.. cost of oil and waste per day of 24 hrs.	$0.18
.. cost of repairs per day of 24 hours	$0.88
Actual cost per boiler H.P. per year of 312 10 hour days	$20.
Actual cost per H.P. per year of 365 24 hour days	$38.